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HEARINGS

ON

INVESTIGATION OF NATIONAL DEFENSE ESTABLISHMENT

STUDY OF PROCUREMENT AND UTILIZATION OF SCIENTISTS, ENGINEERS, AND TECHNICAL SKILLS

SPECIAL SUBCOMMITTEE NO. 6

OF THE

COMMITTEE ON ARMED SERVICES

HOUSE OF REPRESENTATIVES

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INVESTIGATION OF NATIONAL DEFENSE—PHASE II

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SPECIAL SUBCOMMITTEE No. 6,
Washington, D. C., Friday, March 14, 1958.

The subcommittee met at 2 p. m., Hon. F. Edward Hébert, chairman of the subcommittee, presiding, with Mr. Hess.

Mr. COURTNEY. Mr. Chairman, Mr. Kitchin is absent on official business, and Mr. Hardy is out of the city and may be back probably before the meeting recesses. Mr. Wilson has reported already.

Mr. HÉBERT. The committee will be in order.

Mr. COURTNEY. Mr. Chairman.

Mr. HÉBERT. Mr. Courtney.

Mr. COURTNEY. This has to do with the subject of scientists and engineers—technical personnel, generally called scientists for want of a far shorter title, and the instructions of the subcommittee to inquire into the position of the services, both military and civilian personnel, on the quantitative and qualitative requirements or shortages as the case may be.

We have invited here in behalf of the Department of the Navy, this afternoon, Rear Adm. Robert E. Cronin, who is the Chief of Industrial Relations Branch of the Department of the Navy. He will speak primarily with reference to the civilian personnel, and Rear Adm. M. E. Dornin, who is Assistant Chief of Naval Personnel for Plans, addressing himself to the military and other pertinent factors on uniformed personnel on that same subject, as well as Brig. Gen. James F. Berkeley of the Marine Corps.

Mr. Chairman, this is in pursuance of the mandate from the full committee.

Mr. HÉBERT. These gentlemen have not been sworn?

Mr. COURTNEY. They have not.

Mr. HÉBERT. Will you gentlemen rise and raise your right hand, please. You and each of you do solemnly swear that the testimony you will give before the subcommittee in the matters now under consideration will be the truth, the whole truth and nothing but the truth, so help you God?

General BERKELEY. I so swear.

Admiral CRONIN. I do.

Admiral DORNIN. I do.

Mr. COURTNEY. Mr. Chairman, each of these witnesses has very kindly prepared a statement in full, in their response to the subcommittee's inquiry, and would probably prefer to put the statement in full in and to summarize its context, and then respond to questions, if that is agreeable with the committee.

Mr. HÉBERT. You may proceed in any manner that you desire. Who is going to testify first?

Mr. COURTNEY. Admiral Cronin.

Mr. HÉBERT. As I understand it, you wish to submit the full statement for the record, but summarize now and then answer questions?

Admiral CRONIN. Yes, sir.

Mr. HÉBERT. You desire, each of you, to summarize in your own individual way, or there will be only one statement?

Mr. COURTNEY. There will be three statements, Mr. Chairman.

Mr. HÉBERT. Three statements. Admiral, will you proceed.

Mr. COURTNEY. May the statement appear, Mr. Chairman, as though read in full?

Mr. HÉBERT. That is correct.

(The statement is as follows:)

STATEMENT OF REAR ADM. ROBERT E. CRONIN, CHIEF OF INDUSTRIAL RELATIONS OF THE DEPARTMENT OF THE NAVY

Admiral CRONIN. I am Robert E. Cronin, rear admiral, USN, Chief of Industrial Relations of the Department of the Navy, and I have been designated to represent the Department of the Navy on the civilian personnel aspects of today's hearings. The Department appreciates the opportunity to present its views on this subject.

I have with me Mr. Gerow and Mr. Crosby of the Office of Industrial Relations.

The Department of the Navy engages in a wide variety of scientific and engineering activities incident to the construction, overhaul, and repair of ships, aircraft, missiles, and ordnance, mechanical, electrical, and electronic equipment, the maintenance of its facilities, and in research and development projects related to those items. The Navy's employment of approximately 18,000 professional workers in such tasks makes it one of the largest employers of scientific and engineering personnel in the United States.

I have two charts here which will show the distribution of the Navy scientific and engineering personnel as a sort of a backdrop.

A large number of these 18,000 professional workers are employed by the Office of Naval Research, the Bureaus of Aeronautics, Ordnance, Ships, and Yards and Docks in the Washington area, and approximately 50 research and development activities, shipyards, air stations, and ordnance plants throughout the United States.

The second chart shows the distribution of these engineers and scientists insofar as the particular field of effort or the discipline in the case of the scientists is concerned.

Occupationally the professional scientific and engineering work force is divided into five major groups. The approximate proportion of each group to the total professional scientific and engineering force is as follows:

Engineering (including civil, mechanical, electrical, electronic, marine, aeronautical, ordnance, and other), 65 percent; physical sciences (including physicists, metallurgists, chemists, astronomers, oceanographers, and other scientists), 26 percent; mathematics, 4 percent; medical (including physicians, dentists, and nurses), 4 percent; and biological sciences (biologists, zoologists, etc.), 1 percent.

The Navy also employs approximately 8,000 subprofessional scien-

tific and engineering personnel. These are primarily employed as draftsmen, and in engineering and physical science aid positions.

Since 1950, the Navy has been unable to recruit and retain a completely adequate work force of professional scientific and engineering personnel. The problem has been complicated by the fact that the Navy's requirements for scientific and engineering services were increasing at a time when it was all but impossible to replace experienced professional personnel who resigned, and even extremely difficult to hire inexperienced college graduates.

Although somewhat more severe in certain areas of the country than others, the problem has been nationwide in scope, and has affected almost all scientific disciplines and fields of engineering. Because of the cumulative nature of the problem, its severity increased markedly as time went on. A survey of those bureaus and activities which are the major employers of scientists and engineers within the Naval Establishment indicated that as of December 31, 1956, a drastically high percentage of professional positions at or above the GS–9 level were vacant.

Mr. HÉBERT. What salary is that, Admiral?

Admiral CRONIN. I have it here, sir. GS–9 is $5,440 starting salary and $6,250 as a maximum step.

Mr. COURTNEY. Yes.

Mr. HÉBERT. When we speak in the classification, it is confusing. We would rather have the salary.

Admiral CRONIN. In the engineering group approximately 19 percent of these positions were vacant, in the physical sciences group 13.5 percent were vacant, and in the mathematics group 28 percent were vacant. This situation continued throughout most of 1957. Although there are some indications that the severity of the problem may have lessened somewhat in the past few weeks, the problem will continue to impair the Navy's ability to carry out its assigned missions until corrective actions become effective.

Mr. COURTNEY. What is the Navy experience on rate of attrition? Do you have it by any percentage or numbers?

Admiral CRONIN. There is an average separation rate of engineers and scientists of 2.4 percent per month, as opposed to the navy-wide rate of 1.8 percent per month, in the last quarter of 1957.

I believe this is particularly significant, Mr. Chairman, when normally you would expect the greater turnover to be in the blue collar ratings and in the lower clerical ranges, rather than the engineers and scientists, because of the lack of stability of that type of work.

Mr. COURTNEY. You mean the blue-collar worker?

Admiral CRONIN. Yes, sir.

The following occupational categories are in critical supply:

Theoretical and research physicist
Theoretical and research chemist
Theoretical and research engineers (all options)
Mathematicians with computer experience
Naval architects
Metallurgists
Electronic engineers
Mechanical engineers
Chemical engineers

Engineers with experience in the following:
Guidance control systems
Inertial guidance
Instrumentation
Telemetering
Servomechanisms
Simulations

It is noted that while physicists and engineers may be available, frequently those in the labor market are not capable of performing the highly theoretical work required by the missile and satellite programs.

CURRENT VACANCIES

Ten major laboratories report that they have currently 187 vacancies for physical scientists, 322 vacancies for engineers and 11 vacancies for mathematicians. Based upon current attrition rates, it is estimated that 2,700 to 3,000 scientists and engineers will be required for replacements during the next 12 months.

SEPARATION DATA

The last complete quarter for which separation rates are available is for the period September 1, 1957, through November 30, 1957. During this period the rate was:

	Percent
Engineers	7.8
Physical scientists	6.8
Mathematicians	6.5

This represents an average separation rate of 2.4 percent per month as opposed to a navywide average of 1.8 percent per month for the last quarter of 1957. This is significant when it is recognized that it is generally accepted that higher turnover occurs among blue-collar workers in lower level positions and among clerical workers in the lower grades.

In 1956, an extensive attitude survey of scientists and engineers was made within the Department of the Navy, along with the Department of the Air Force and certain other Government agencies. The results of this study were summarized in the "Summary Report of Survey of Attitudes of Scientists and Engineers in Government and Industry" issued by the Committee on Engineers and Scientists for Federal Government Programs. Throughout the Navy a random sample was made of about 50 percent of all engineers and scientists within the continental United States. Approximately 6,800 Navy engineers and scientists responded to the questionnaire.

This study, along with the study conducted by the Defense Advisory Committee on Professional and Technical Compensation (the Cordiner committee), indicated that the most significant problem area is that of inadequate compensation for engineers and scientists.

Two-fifths of the attitude survey respondents in Government and industry alike felt that their own job required less experience, training, and ability than they possessed; the same proportion also reported that they spent 25 percent or more of their time performing duties of a nontechnical nature.

About half of all of the respondents felt that most of their nontechnical duties could be performed by nontechnically trained persons. Two-thirds of the Navy scientists and engineers are dissatisfied with their opportunities of salary advancement as opposed to one-fourth of industry people who are also dissatisfied.

Dissatisfaction was also expressed with the Federal classification system. The scientists and engineers believe that adequate classification of a professional position cannot be done by a person untrained in that profession, that the more productive of the persons doing the same work should receive a higher salary, that a separate category for professional employees would aid in recruitment and retention of scientists and engineers and that salaries should be tied into the cost of living of local communities.

Mr. COURTNEY. That relates to the Civil Service classification you are speaking of now?

Admiral CRONIN. That is correct.

Mr. COURTNEY. Not a Navy Department classification?

Admiral CRONIN. No. Navy Department based on civil service.

Mr. COURTNEY. Yes; but Civil Service is the one who sets the standards.

Admiral CRONIN. That is right.

Mr. COURTNEY. And makes the actual classification.

Admiral CRONIN. That is correct.

Mr. COURTNEY. The Navy Department sets up the job by description. And that, then, is given a civil-service rating?

Admiral CRONIN. That is correct.

Mr. COURTNEY. Is that what you mean?

Admiral CRONIN. Yes, sir.

Half to three-quarters of all the respondents think either management or technical training, or both, would help them to do their job better. Eighty percent favor financial support by the organization for such further training.

Concerning fringe benefits, Government was seen as more favorable than industry in some areas, including annual leave, sick leave, and retirement; in other areas such as hospitalization benefits, Government was given a secondary position.

CURRENT STATUS OF LABOR MARKET

A review of the registers has been made of the three largest and most significant boards of United States civil service examiners recruiting scientific and engineering personnel. These Boards are the Navy Department Board of United States Civil Service Examiners; the Potomac River Naval Command Board of United States Civil Service Examiners for Engineering and Scientific Personnel; and the Board of United States Civil Service Examiners for Engineering and Scientific Personnel, Pasadena, Calif. These Boards have registers for almost all fields and grades of engineering, physical sciences, and mathematical positions.

The registers are generally small in number and frequently eligibles are available only for lower grades. Gross numbers do not reflect the actual number available, since approximately 50 percent of the applicants are eligible for more than one grade. In addition, 50 percent of all eligibles are presently Federal employees seeking pro-

motion. Also, experience indicates, that of those eligible, declinations will result when offers of employment are extended as follows:

	Percent
Grades GS–5 to 7	50–75
Grades GS–9 to 11	25
Grade GS–12	15
Grade GS–13	10
Grades GS–14 and 15	3–5

Many of those eligible on such registers lack quality experience or have no experience in the critical specializations.

There has been some easement of the problem during the last 4 months. It appears that this has resulted from some termination of industry contracts by the Defense Department. There is evidence of reduction in the gross recruiting effort by private industry and there appears to be in progress a weeding out of marginally satisfactory engineers and scientists by industry. The evidence of such marginally qualified engineers and scientists has appeared principally on the west coast. The result is that many of these applicants available have minimum qualifications or are not qualified in the highly theoretical areas of shortage.

At this time, it is difficult to predict the effect of the softening of the labor market on our recruitment effort. It is, however, our present belief that this apparent softening in its present proportions will not affect our problems since there is no surplus, nor is any likely, of the highly qualified and specialized people we are trying to employ.

As indicated above, even to maintain the present level of employment, significant intake is required. Any decision to accelerate existing programs will present new personnel demands in addition to the replacements required for continuing programs. For example, expansion of missile testing is anticipated by the Bureau of Aeronautics. Similarly, acceleration of existing contracts will deplete the supply of currently available engineers and scientists.

In connection with what is being done to alleviate the shortage. I would like to show a chart here, in the matter of compensation which we feel is the most crucial of the problems facing us in getting engineers and scientists.

Currently, the Congress is considering pay legislation for all employees subject to the Classification Act of 1949, as amended. Such legislation will apply to the majority of the Navy's scientists and engineers.

I have a chart which reflects the prevailing industry salaries, current Federal salaries and the improved conditions which would accompany enactment of the kind of pay legislation receiving consideration at this time.

ADVANCED IN-HIRING RATES

In accordance with section 803 of the Classification Act, as amended, the Civil Service Commission may establish the in-hiring rate for the respective grades in shortage category occupations at one of the steps above the minimum, upon a finding that such action would improve the Government's recruiting prospects and enhance the possibility of meeting the Government's need.

In May of 1957, the Department of the Navy recommended to the Civil Service Commission that the rate be raised to the top of the

grade for all professional engineers, physical scientists, mathematicians, and architects.

Prior to that time, the Commission had authorized the maximum step as the in-hiring rate for grades GS–5 and GS–7; the fourth step for grade GS–9, and the sixth step for grade GS–11. The Navy recommended extending this through grade GS–15. Favorable action was taken upon the Navy recommendation in December of 1957. The maximum step of the grade is now authorized at all grade levels from grade GS–5 through grade GS–17.

Mr. HÉBERT. For the record, right at this point, Admiral, will you call out the salaries that you are speaking of, in dollars.

Mr. COURTNEY. Start with $3,500 as a base for this computation, Admiral.

Admiral CRONIN. Yes, sir; that is right.

This shows the starting salaries from the positions GS–5 and GS–7 through GS–15, and the starting salary from $4,500 up through the GS–15 salaries of $14,500 to $15,000, all the way up the range.

Mr. HÉBERT. As I understand, your greatest problem is above $5,400, is that correct, or GS–9?

Admiral CRONIN. It was GS–9 and above.

Mr. HESS. Do I understand, on that chart, Admiral: You start an engineer at $3,500 as against $5,000 a year in industry?

Admiral CRONIN. No, sir, that is $4,500.

Mr. HESS. That is to date. But at that time, as I understand it, in 1956, when the Cordiner Committee made its survey, isn't the small black block the one indicating the amount?

Admiral CRONIN. No, sir. It is only the first block in each group where that applies. The other blocks on the top show the range from the starting to the end.

Mr. HESS. I see.

Admiral CRONIN. In other words, that is the total range of advancement steps.

Mr. HESS. Then it is $5,000 as against $4,500?

Admiral CRONIN. Yes, sir; that is right.

Mr. HÉBERT. Are you speaking of college graduates?

Admiral CRONIN. Yes, sir; generally speaking, that is correct.

Mr. COURTNEY. Well, then, we would understand that the starting range for graduate engineers, or at least a degree in whatever profession it might be, would in the Navy start at $4,500, whereas the industry rate would be in excess of $5,500 for a comparable position; is that correct?

Admiral CRONIN. That is correct.

Mr. COURTNEY. That is the way we read the chart?

Admiral CRONIN. Yes, sir; that is correct.

Mr. COURTNEY. And under the proposals that are now pending in Congress, the 3 blocks, the 3 remaining blocks, are positions that the Government would be in under any 1 of 3 pending bills?

Admiral CRONIN. Yes, sir.

Mr. COURTNEY. And that same convention holds true on all of the blocks that are shown on the chart?

Admiral CRONIN. That is right.

Mr. HESS. So that in your competition with private industry in all of the grades that are stated here on the chart—you are considerably

below salaries paid in private industry, even though any 1 of the 3 bills would be passed?

Admiral CRONIN. That is correct, sir.

Mr. COURTNEY. That is $4,500 compared with about $5,600 or $5,700 in industry, as of now; is that right?

Admiral CRONIN. Yes, sir.

Mr. HÉBERT. I think it is of interest that the Defense Department and the Navy pay chauffeurs, drivers, $2 an hour for a 40-hour week, and that is $80 a week for driving an automobile, and engineers—that is why I asked the question, and graduate engineers earn $4,500. Imagine the man driving an automobile getting $2 an hour.

Admiral CRONIN. In the matter of recruitment, the recruitment of engineering and scientific skills and knowledges for civilian positions in the Navy must conform to the competitive examination and appointment requirements of the Federal Civil Service System. Open competitive examinations for scientific and engineering positions are maintained in all areas.

The United States Civil Service Commission has provided procedures whereby any qualified applicant may be immediately appointed if the Navy obligates itself to employ any chance eligibles that may exist on the appropriate examination register.

The most intensive recruitment for scientists and engineers is found in the Departmental Board, the Pasadena Board and the Potomac River Naval Command Board mentioned earlier.

The Departmental Board conducts examinations for positions existing in the bureaus and offices of the Navy Department. The other Boards referred to above service a number of laboratories and test activities in their general geographical areas.

I have some examples, brochures, which I would like to leave with the committee for your information.

Mr. COURTNEY. Thank you, Admiral.

Admiral CRONIN. The recruitment programs include wide publicity of employment opportunities; furnishing technical speakers to high schools, junior colleges and universities to stimulate public interest; providing speakers and encouraging attendance among scientists and engineers at professional society meetings and assemblies; screening for possible employment Naval Reserve officers separating from active duty and qualified in an engineering or physical science; and lastly, nationwide campus visitations.

The individual components of the Department of the Navy have developed attractive formats for announcing employment opportunities. This material includes brochures which present program, facility, and equipment information in a manner designated to stimulate interest of technically qualified persons. I have examples of such brochures which I would like to leave with the committee.

The overwhelming majority of available applicants for entrance level positions of scientists and engineers are obtained from campus visitations to colleges and universities. Such programs have been conducted annually and regularly throughout the United States by all of the scientific and engineering activities of this Department.

Experienced scientists and engineers are obtained from industry or other Government sources. Some experienced people are recruited from faculties of colleges and universities.

Recruitment costs vary widely. The variance results from whether the recruitment is for junior engineers and scientists by visits to college campuses or whether the purpose of the recruitment is to obtain experienced engineers and scientists.

A comparable study of recruiting costs made for the school year 1954–55 and for the calendar year 1957 by the Pasadena Board indicated that for 1954–55 the cost per recruit was $172. By 1957 costs had increased to $461 per recruit. These costs reflect travel costs and salaries of recruiters. This recruitment was entirely campus recruitment which is at a lower average cost per recruit than that for experienced engineers and scientists.

Information received from the bureaus indicates a somewhat higher figure for experienced engineers and scientists. We estimate the average Navy cost per recruit to be $650 for travel and salaries of recruiters.

THE WORK-STUDY PROGRAM

Th Navy's work-study program represents one of the most recent efforts to alleviate the shortage of scientists and engineers. This program is designed for undergraduate students of engineering, science, and mathematics, and interested in a civilian career with the Navy.

The young people in these programs are part-time employees and part-time students. Their schedules of work and study vary—alternating by quarters or semesters; a half day in school and a half day at work; or a workweek divided between school and work. Summers generally are spent on the job.

Mr. HÉBERT. In other words, you send these students to an accredited university?

Admiral CRONIN. Yes, sir.

Mr. HÉBERT. You have a school within the Navy?

Admiral CRONIN. No, sir. We make an arrangement with the university whereby they will spend part of their time—either 1 week, alternating, or by semesters or by part-day work and part day at school depending upon, of course, the location of the university.

Mr. HÉBERT. And you pay half of the tuition?

Admiral CRONIN. Yes, sir, we are allowed to pay up to half of the tuition.

Mr. HÉBERT. And what obligation does the student have for that half?

Admiral CRONIN. We require that they agree to sign—they sign an agreement to stay with the Navy a length of time, dependent on how much aid they have had during their time.

Mr. HÉBERT. What is that yardstick?

Admiral CRONIN. Approximately 18 months for our full work study program, sir, that is 18 months to remain with the Government.

Mr. COURTNEY. In addition to the time during which he will have work part time.

Admiral CRONIN. That is right.

Mr. HESS. He is an enlisted man or civil service employee?

Admiral CRONIN. He is a civil service employee, part-time employee.

Mr. HESS. You have no way to keep him there if he decides not to stay with you?

Admiral CRONIN. We have his agreement, yes, sir.

Mr. HESS. Well, what is his agreement worth? You are not going to sue him.

Admiral CRONIN. We can sue him, sir.

Mr. HESS. Oh, you can?

Mr. HÉBERT. Do you have any problem?

Admiral CRONIN. No, sir.

Mr. HÉBERT. They do live up to the agreement?

Admiral CRONIN. Yes, sir.

Mr. COURTNEY. Admiral, this program or the maintenance of a program of this kind would depend upon the location of the school and your naval activities?

Admiral CRONIN. That is correct.

Mr. COURTNEY. So you are limited by geography, among other things?

Admiral CRONIN. Yes, sir. That is one of the most important features of it.

Mr. HESS. You don't resort to these so-called cooperative courses that are carried out?

Admiral CRONIN. Yes, sir. We have those in addition. I am going to mention those in just a moment.

The student-trainees are career-conditional appointees, selected from registers based on a written examination especially constructed for student-trainees. Grade ranges from GS–2 to GS–5. Freshmen are appointed as GS–2's. Promotions are scaled to the academic standing, fixed by the United States Civil Service Commission. Salaries are paid only during periods of work. The Navy is giving some financial assistance, not to exceed one-half of the total program costs, toward educational expenses such as tuition, registration, and laboratory fees and books.

The current academic year in the first year of the plan's operation and it is too early to assess its effectiveness in actually providing the Navy with young scientists and engineers. However, the data on present participation is encouraging. There are 443 freshmen; 92 sophomores; 34 juniors; and 13 seniors——

Mr. COURTNEY. Then it doesn't extend to the master's degree or anything of that kind?

Admiral CRONIN. No, sir, this is an undergraduate program.

A total of 582 students who are part-time employees of the Navy and are being helped to finance their college education. The advanced students in the pipeline will help us to realize some small benefit from the program each year beginning with June 1958, until the first large group graduates in 1962. Some of the advanced students were Navy employees who had been in after-hours programs and some were pursuing this education on their own. Others were students who had been employed with the Navy during summers.

These student-trainees represent 18 fields of specialization essential to the Navy's mission. Some of the concentrated areas in engineering specialties are: 159 in mechanical, 120 in electrical, 60 in electronics, and 108 in general engineering. Forty-four students are studying naval architecture. In the sciences, we have 16 in physics, 8 in chemistry, and 2 in metallurgy. There are two students of mathematics. Thirty-two field activities are utilizing this work-study pro-

gram and have students in 39 colleges and universities and 13 junior colleges.

Once these student trainees are well established in the program, they become productive and can do many types of work to assist senior engineers and scientists. Work assignments increase in difficulty and are coordinated with the study.

In addition to the student trainees receiving financial assistance, there are several hundred cooperative education students who are spending the work-experience phases of their programs of study in the Navy. These students are not necessarily interested in civilian careers with the Navy and may or may not come to the Navy when they graduate.

Mr. HESS. Before you leave that cooperative program, do you have any arrangement with these colleges to carry on the program? I am thinking primarily of the one in my own hometown, the University of Cincinnati, and a few years ago when we had the airframe investigation here we found that Martin, for instance, had a number of students who would work in the plant down there for a few months at a time and then go back to school.

Do you have any such arrangement in the Navy?

Admiral CRONIN. Yes, sir; this is the arrangement we have with the colleges.

Mr. HESS. You make that?

Admiral CRONIN. Yes, sir. Part-time students and part-time working.

Mr. HESS. Then you just pay that student a salary while he is on duty or working for the Navy?

Admiral CRONIN. That is correct. We, of course, can't pay him while he is going to school.

Mr. HESS. Of course. I understand.

Admiral CRONIN. Incidentally, we have an arrangement with the University of Cincinnati, that is the Navy has an arrangement.

Mr. HÉBERT. I think it would be good for the record, just supply for the record, the institutions that you do have working arrangements with, so we will know how it is spread geographically.

Admiral CRONIN. The Department of the Navy presently has work-study arrangements with 52 educational institutions throughout the continental United States. A list of these institutions is as follows:

LIST OF EDUCATIONAL INSTITUTIONS PARTICIPATING IN THE NAVY'S WORK-STUDY PROGRAM DURING 1957–58

Alabama Polytechnic Institute, Auburn, Ala.
Antioch College, Yellow Springs, Ohio
California Institute of Technology, Pasadena, Calif.
Chico State College, Chico, Calif.
City College of San Francisco, San Francisco, Calif.
College of the Pacific, Stockton, Calif.
Dartmouth College, Hanover, N. H.
Drexel Institute of Technology, Philadelphia, Pa.
Fenn College, Cleveland, Ohio
George Washington University, Washington, D. C.
Georgia Institute of Technology, Atlanta, Ga.
Howard University, Washington, D. C.
Illinois Institute of Technology, Chicago, Ill.
Johns Hopkins University, Baltimore, Md.
Long Beach City College, Long Beach, Calif.
Long Beach State College, Long Beach, Calif.
Marquette University, Milwaukee, Wis.
Massachusetts Institute of Technology, Cambridge, Mass.
Northeastern University, Boston, Mass.

LIST OF EDUCATIONAL INSTITUTIONS PARTICIPATING IN THE NAVY'S WORK-STUDY PROGRAM DURING 1957–58—Continued

Northwestern University, Evanston, Ill.
Pasadena College, Pasadena, Calif.
Pennsylvania State University, State College, Pa.
Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
Pomona College, Claremont, Calif.
Pratt Institute, Brooklyn, N. Y.
San Diego State College, San Diego, Calif.
Seattle University, Seattle, Wash.
University of California, Berkeley, Calif.
Stanford University, Stanford, Calif.
University of California, Los Angeles, Calif.
University of Chicago, Chicago, Ill.
University of Cincinnati, Cincinnati, Ohio
University of Maryland, College Park, Md.
University of Michigan, Ann Arbor, Mich.
University of Southern California, Los Angeles, Calif.
University of New Hampshire, Durham, N. H.
University of Tennessee, Knoxville, Tenn.
University of Virginia, Charlottesville, Va.
Virginia Polytechnic Institute, Blacksburg, Va.

JUNIOR COLLEGES [1]

Compton District Junior College, Compton, Calif.
E Contra Costa Junior College, Concord, Calif.
Los Angeles Harbor Junior College, Los Angeles, Calif.
Marin Junior College, Kentfield, Calif.
Napa Junior College, Napa, Calif.
Oakland Junior College, Oakland, Calif.
Olympic Junior College, Bremerton, Wash.
Sacramento Junior College, Sacramento, Calif.
San Mateo Junior College, San Mateo, Calif.
Santa Rosa Junior College, Santa Rosa, Calif.
St. Mary's Seminary Junior College, St. Mary's County, Md.
Vallejo Junior College, Vallejo, Calif.
Ventura Junior College, Ventura, Calif.

Now other training programs:

There is considerable emphasis on continuous training of scientists and engineers. Technological advances alone demand this but in addition the Navy's management recognizes the value to the individual in having opportunities to continue his education and widen the scope of his competency. Accordingly, there is continual encouragement, guidance, and other assistance offered to employees so that they will participate in training and educational activities at both undergraduate and graduate training level.

While there is general understanding that in-service training will serve as the principal means of training, a large share of professional training is provided by outside educational training facilities. This is particularly true of advanced study and new areas of endeavor.

The training assumes many different patterns which is reasonable to expect since it must fit the individual's needs, the Navy's needs, and the schools' course of study with its prerequisites and other requirements.

Many scientists and engineers having access to colleges and universities that sponsor evening classes are enrolled in organized courses of study leading to degrees—some are masters and doctoral candidates. In field activities geographically removed from educational centers, after-working-hours programs are provided at the activity. Instruc-

[1] The programs of study offered at the junior colleges are coordinated to permit continuation in a 4-year college or university, usually within the network system of higher education in the State.

tors from schools within commuting distances travel to the activity to provide the training.

In addition to the standard curriculum offered by universities and colleges there are some instances where the course of study has been planned by representatives of the Navy and officials of the school to insure training suited to the Navy's unique needs. Some examples are a course in aeronautical engineering at the Massachusetts Institute of Technology; advanced graduate training in hydrodynamics of naval architecture at the University of California; and a degree-granting program in cartography at the Navy Hydrographic Office, conducted at the activity by George Washington University.

There is also heavy participation in short courses offered by leading educational institutions throughout the country. This training is usually of 2 or 4 weeks' duration. Although the training is consistent with the Navy's needs, it is an unusual opportunity for the development of the employee's career, particularly when the training is at Government expense and on Government time.

In connection with the long-range programs I mentioned earlier, it should be stated that there is frequently a sharing of tuition and related educational costs by the Navy and the employee.

During calendar year 1957, several thousand engineers and scientists in the Navy have received training in facilities outside of the Navy. The total tuition cost was approximately $800,000.

ATTENDANCE AT PROFESSIONAL MEETINGS

It is the Navy's policy to encourage its engineers and scientists to attend and participate in meetings of technical, scientific, professional and other similar organizations as a means of furthering their personal competency. Such attendance is considered necessary to the continuing development of the engineer and scientist and to enable the Navy to keep abreast of technical advancements.

In order to facilitate the use of this medium as an important factor in the recruitment, retention, and development of engineering and scientific personnel, it is planned that the Secretary of the Navy will further delegate the authority to approve attendance at meetings and conferences. In addition to chiefs of bureaus and offices having this authority, the commanding officers of activities employing the majority of our scientists and engineers will also have the authority to approve conference travel.

PAID ADVERTISING

Formerly, regulations of the Civil Service Commission have prohibited the utilization of paid advertising to recruit employees for the Federal service. The Commission recently reversed its earlier policy and authorized departments and agencies to place advertisements in professional, scientific, and college journals. Advertisements may be placed in general circulation newspapers and in college newspapers to announce the presence of a recruiter in the area.

The Department has implemented the Commission's authority by an instruction from the Secretary and delegated to chiefs of bureaus and offices the authority to place advertisements in professional and trade journals. The bureaus and offices are now surveying their field activities to determine the extent paid advertising will be required to

meet recruitment needs. The first such advertisement has been placed by the Naval Ordnance Laboratory, White Oak, and will appear in the April 1958 issue of Physics for Today.

Mr. COURTNEY. Is the Department of the Navy regulated with respect to advertising and recruitment costs by the Civil Service Commission?

Admiral CRONIN. Yes, sir.

Mr. COURTNEY. I think that had not been known up to this point.

Admiral CRONIN. They are the regulatory body for methods of recruitment.

Mr. COURTNEY. Well, pursue that a little further.

Mr. HÉBERT. Yes, I would like to have you elaborate on that; why the Civil Service Commission has anything to do with it.

Mr. COURTNEY. Regardless of your needs and regardless of the classification, which is something else again, of the employees whose job description is laid out in the job statement, Civil Service Commission exercises control over your recruitment?

Admiral CRONIN. Only over the question of what type of recruitment we will engage in, sir. And this would be—their regulations were opposed to paid advertisement by the Federal Government.

Mr. COURTNEY. Well, who pays the bill, the Commission or the Department of the Navy?

Admiral CRONIN. The Department of the Navy.

Mr. COURTNEY. Then you are regulated as to what expenses you may incur, by reason of regulations of the Civil Service Commission?

Admiral CRONIN. They do, however, now permit the advertising.

Mr. HÉBERT. But the idea is: Here is an agency that does not expend and is not responsible for the money and controls the expenditure. Do you know by what authority that is exercised?

Admiral CRONIN. The Civil Service Commission advised us that the legal authority for their regulation which formerly prohibited the use of paid advertising in the recruitment of employees, is contained in the Civil Service Act of January 16, 1883 (22 Stat. 403; 5 U. S. C. et seq.; 40 U. S. C. 42). Section 2 of this act requires the Civil Service Commissioners—

> To aid the President, as he may request, in preparing suitable rules for carrying this act into effect * * *

Mr. HESS. Does that hold true with all the services, too; do you know?

Admiral CRONIN. Yes, sir, with all agencies of the Government.

Mr. HESS. And when this change was put into effect, it applied to all agencies?

Admiral CRONIN. Yes, sir; that is correct.

Mr. COURTNEY. Does the Civil Service Commission exercise any control by way of regulation over or any other control by way of regulation over the training program that you have just outlined?

Admiral CRONIN. No, sir. This is a matter of our compliance with the law.

Mr. COURTNEY. Yes.

Admiral CRONIN. The Civil Service Commission could, of course, establish some regulations if the law permitted them to do that. In

other words, if the law provided that the Civil Service Commission should set up regulations to interpret the law——

Mr. COURTNEY. Granted that, but the question directed directly to you is this—You have just described a training program. And the question would be whether any regulation of the Civil Service Commission interferes with that or regulates it?

Admiral CRONIN. No, sir, I don't believe so, sir.

Mr. COURTNEY. Very good.

Admiral CRONIN. We, of course, do have a policy on training from the Department of Defense which all three military Departments comply with.

Mr. COURTNEY. Yes, sir.

Admiral CRONIN. It is anticipated that this authority will provide the kind of flexibility required for the effective recruitment of scientists and engineers.

DELEGATION OF CLASSIFICATION AUTHORITY

The attitude surveys conducted in 1956 indicated that scientists and engineers were dissatisfied with the Federal classification system. In late 1956, the Department of the Navy delegated classification authority to Chiefs of Bureaus and Offices and to commanding officers of field activities. It is believed that this delegation of authority has reduced the feeling of dissatisfaction noted in the surveys.

Mr. COURTNEY. Now, Admiral, so we will be clear in the record on that, that means in effect the man's immediate superior is the man who describes the job which he is filling?

Admiral CRONIN. That is correct.

Mr. COURTNEY. But that does not give the commander or the head of the institution in the Navy the right to determine the salary that will be paid for that job?

Admiral CRONIN. It gives him the authority and the responsibility to allocate that position.

Mr. COURTNEY. That position?

Admiral CRONIN. Yes, sir.

Mr. COURTNEY. In other words, he sets up the job, what the job is to be?

Admiral CRONIN. Yes, sir.

Mr. COURTNEY. In defining what is to be done. But he does not fix the rating in dollars that would be given for it?

Admiral CRONIN. Well, he does in effect because he establishes the level of the position.

Mr. COURTNEY. In other words, if he pushes the job description high enough, the Civil Service Commission has got to fix the rating proportionately, is that it?

Admiral CRONIN. Yes, sir, but, of course, the Civil Service Commission comes in and makes an inspection roughly every 18 months to determine that positions are properly allocated.

Mr. COURTNEY. In other words, whether the man in the job which has been described on his classification sheet is actually performing the duties? Which that job sheet calls for?

Admiral CRONIN. That is correct. They make an evaluation.

UTILIZATION OF SCIENTISTS AND ENGINEERS

Within the Navy the bureaus, offices, and naval activities are giving constant attention and emphasis to the maximum utilization of scientists and engineers. A number of programs have been designed to use more fully the available engineering and scientific personnel.

Scientific and engineering positions have been reengineered to exclude nonprofessional, administrative, and substantially lower grade professional duties. Positions of staff administrative assistant—"Man-Friday" positions—engineering technicians, and equipment, ordnance and production specialists have been established to assume the duties not specifically requiring full professional background.

The employee in the "Man-Friday" position relieves engineers and scientists of paperwork and administrative detail duties, the performance of which does not require scientific and engineering skills and knowledges. The "Man-Friday" position is a management-type position and is not to be confused with higher levels secretarial or clerical positions.

Shop assisted engineering programs have been established in order to relieve engineering departments of workloads that could be performed in another part of the organization, to apply the experience of outstanding mechanical trade personnel to research and development problems.

Functional enginering is another recently developed tool to be employed by the Navy to increase the effectiveness and to obtain full utilization of available manpower and talent of technical and engineering personnel. At present, the best known phase of functional engineering is functional or simplified drafting which is the process of making drawings in a manner which shows only the information required by the user to do his work.

Electronic computers are being used for the solution of scientific and engineering problems. Much computational work formerly performed by engineering personnel is now programed for high-speed computers in the attempt to free the engineer for other engineering duties. While the use of the electronic computers has increased the requirement for mathematicians and physicists generally, the overall result has been highly beneficial to the engineering and scientific manpower requirements.

In January of this year all bureaus and offices of the Navy were asked to consider the following action to effect improved utilization:

1. An identification of those administrative duties which scientists and engineers are commonly required to perform.

2. A determination as to which of these duties can and should be delegated to others.

3. An identification of other nontechnical and nonspecialized duties which could be accomplished by persons who do not have a professional background in the fields of science and engineering.

Check lists developed by the Civil Service Commission were distributed to all naval activities as a possible device for improving the utilization of scientists and engineers. The check lists were designed to help review the professional skills, experience, and potential of scientists and engineers. The lists make special reference to practices and techniques which attitude and management surveys indi-

cate are helpful in increasing the creativity and productivity of scientists and engineers.

A central roster of the Navy's key scientists and engineers in GS–13 and above positions has been established and is maintained by the Chief of Naval Research. The roster is used for these purposes:

1. To identify and locate specific talents for special utilization.
2. To provide broader promotional opportunities.
3. For obtaining further outside public recognition of the Navy's key scientists and engineers.

Through the Office of Naval Research, the Navy actively plans, organizes, and supports scientific institutes and conferences which bring together research scientists to report on and discuss current technical advances. This provides a means for the discovery of gaps in technical knowledge, exchange of information, elimination of misdirected effort and stimulation of ideas.

In March of 1957 the Office of Naval Research held its first science symposium. The symposium was attended by the largest number of scientific personnel ever gathered for such a program. Because of the success of this program, it will be continued on an annual basis.

The President's Committee on Scientists and Engineers was established in 1956 to stimulate the Nation's efforts to meet our growing needs for scientists and engineers. This Committee has inaugurated a nationwide series of local utilization conferences designed to encourage action at the local level to promote maximum use of the Nation's available resources of scientists and engineers. The Navy has endorsed these conferences by informing all bureaus and offices of them and encouraging participation at the activity level.

WHAT NEEDS TO BE DONE. NEED FOR COMPETITIVE PAY

The primary cause for the Navy's difficulties in attracting and retaining an appropriate number of professional scientific and engineering personnel seems to be inadequate compensation. There are a number of aspects to the compensation problem.

First, the Navy, like other employers, must obtain most of its professional employees by recruiting inexperienced college graduates and fitting them for increasingly responsible positions through on-the-job training. The presently authorized in-hiring rates for such personnel do not permit us to compete successfully with private industry for a reasonable share of graduating college students.

Second, currently authorized rates for experienced scientists and engineers (those in GS–9 and higher grades) are sufficiently lower than the salaries offered by industry that many college graduates leave naval employment for better paying positions in private industry after gaining a year or two of experience.

Finally, because of the limited number of Public Law 1028 positions available to the Navy, a "squeeze" exists which forces a number of persons employed in project leader and other top-level scientist and engineer positions, which meet the qualifications for compensation under Public Law 1028, into the GS–15 grade. The lack of proper financial recognition has caused many of these invaluable people to leave the Navy for private industry positions paying substantially higher salaries.

Therefore, the most urgent need at this time is for salary scales which will permit the Navy to compete successfully with private industry for a reasonable share of the professional, scientific and engineering personnel available to the labor market. Early enactment of salary legislation will be helpful in mitigating the Navy's recruitment and retention problems discussed above.

Such legislation should retain the existing provision of the Classification Act which permits the Civil Service Commission to authorize advanced minimum rates for occupations in which a manpower shortage exists. The Navy further believes that any pay increase legislation enacted should also authorize the in-hiring of college graduates in engineering and scientific fields at the GS–7, rather than the GS–5 level. This is needed because prevailing industry in-hiring rates are so considerably in excess of those currently authorized for GS–5, that it would be impossible to provide competitive rates at this most critical point without distorting the entire schedule.

Finally, the Navy believes that any salary increase legislation should eliminate the existing legislative ceiling on numbers of Public Law 1028 positions. This is needed in order to eliminate the present "squeeze" which forces many top-level scientific and engineering positions that qualify for compensation under Public Law 1028 into GS–15.

AUTHORITY OF PAY EXPENSES FOR INTERVIEW AND TRAVEL TO FIRST STATION

Another material cause of difficulty is the Navy's lack of authority to pay the travel expenses of prospective employees visiting naval activities for interviews, and to pay the expenses of travel and transportation of household goods incurred by new appointees and their dependents in reporting to their first duty stations.

The practice of paying such expenses has become generally prevalent in industry, particularly for prospective and newly hired engineers and scientists. Because of the substantial size of such expenses, a job applicant with otherwise equal offers from two or more employers will accept employment with the organization willing to pay his travel expenses. While statistics on this matter are not available, there is reason to believe that many persons who declined offers of Navy employment in engineering and scientific positions, listing inadequate salary as their reason, were influenced by the fact that the Navy could not pay travel expenses to their first duty station.

The Department of the Navy believes that prompt enactment of legislation authorizing the payment of such expenses for applicants for employment and new appointees in critical shortage occupations would be of material assistance in reducing the recruitment and retention problems.

CONTINUED NEED FOR AUTHORITY TO USE OUTSIDE TRAINING FACILITIES

For the past several years the Navy has had authority through the current Department of Defense appropriation act to pay tuition to colleges and universities and other training facilities. In order that the Navy may provide for continuity of planning and take full advantage of the potential abilities of its engineers and scientists, it is impor-

tant that either this authority be continued annually, or training legislation be enacted. The training legislation bill, S. 385, would provide this authority on a continuing basis.

Mr. HÉBERT. Admiral, you have addressed all of your remarks and observations to 18,000 civilian or classified employees—engineers and scientists.

Mr. HESS. I would like to ask one question here, Admiral. I know there must be some reason and I wish you would give it. Say, for example, you find a young engineer and he is in class GS–9 and you find he is an exceptionally brilliant young fellow and you know you are not going to be able to keep him there because of the competition between the Navy and private industry.

What is to prevent you from jumping him up to GS–12? Do you have to wait until there is a vacancy in a position to do that, or can you jump him up?

Admiral CRONIN. We are prohibited from jumping him more than to the next grade by law, sir. We must jump him one grade at a time.

Mr. HESS. All right. Let's say, then, could you jump him from GS–9 to GS–10 one week and then to a GS–11 the next week and up until he was given——

Admiral CRONIN. No, sir. There is a stated time, a stated period, which he must wait.

Mr. HESS. But it isn't necessary to have a vacancy in that particular grade in order to grade him that way?

Admiral CRONIN. Well, yes, sir. That, of course, is an administrative problem. In the activity where he is located, if there were no vacancies there would be no job for him to do. In other words——

Mr. HESS. I mean would you have a certain number of jobs in GS–12, a certain number on GS–13, and so forth and so on?

Admiral CRONIN. Yes, sir, that would be the normal——

Mr. HESS. You couldn't go beyond that?

Admiral CRONIN. Yes, sir, that would be the normal way that would be lined up. There would have to be a specific position for him to fill before he could be promoted to it.

Mr. HÉBERT. Suppose you needed an X number of GS–10's or an X number of GS–12's and you had no need for the other categories. You couldn't employ those people in those different areas?

Admiral CRONIN. They can be detailed to those positions for a short time, sir. But as a permanent solution, of course, you would have to go out and actually get the right grade people off the Civil Service Commission registers, the right grade people.

Mr. HESS. In the meantime, you would lose a man, who is a very, very valuable man.

Admiral CRONIN. Well, you wouldn't have him in the first place unless—that is normally—you had the vacancy, or unless you had the spot for him, the position.

Mr. HESS. I mean, you brought him in as a GS–9 or a GS–10 and you find that he is an exceptionally brilliant young fellow and you want to keep him, but you have no place for him because the civil-service regulations and rules won't permit you to.

Admiral CRONIN. They move up fairly rapidly, sir.

Mr. HESS. They do?

Admiral CRONIN. Yes.

Mr. COURTNEY. Is that because of the high rate of attrition?

Admiral CRONIN. Yes, sir, that is correct.

Mr. COURTNEY. Something over, almost 25 percent a year.

Admiral CRONIN. Those who want to stay don't normally get stagnated in a position. They normally move.

Mr. HÉBERT. Your attrition rate is 25 percent?

Mr. COURTNEY. Two percent a month.

Admiral CRONIN. Yes, sir, that is correct, 2.4 percent a month, that is according to our last full quarter.

Mr. HÉBERT. That is higher than industry, which is 17 percent. I am speaking of the airframe industry.

What is the caliber of the individual that you find? Do you find these individuals well grounded, or do you find them lacking in some respects, in educational approach?

Admiral CRONIN. Well, sir, in order to take on any of these engineers in these various grades, they must fulfill the minimum qualifications which are established by the Civil Service Commission. In other words, they must have a degree or equivalent experience.

Now, of course, like in any other field, they vary an awful lot between individuals. A man who can meet the minimum qualifications can be hired, of course, but among 50 people you will have the same variation in abilities that you do in any other field of endeavor. They vary quite a lot.

Mr. HÉBERT. What percentage have a degree?

Admiral CRONIN. I don't have that figure, sir.

Mr. HÉBERT. Can you estimate it, hazard a guess?

Admiral CRONIN. Of all the engineers and scientists, sir?

Mr. HÉBERT. Yes.

Admiral CRONIN. In this attitude survey, Mr. Chairman, I have a figure which indicates that all the scientists and engineers who responded—there is an indication that 55 percent had baccalaureate degrees.

Mr. HÉBERT. Therefore, the education which the Navy subsidizes is 45 percent of them, that is an undergraduate subsidization that you have. In other words, you send them to school. If they have a degree, you don't send them back to school again, because they have a degree.

Admiral CRONIN. No, sir. There, of course, would be a possibility of our going that high to assist the others in getting their degree while they were doing a job for the Navy. However, we do send even the graduate, that is those who have degrees—we send them to graduate courses where those courses help the Navy.

Mr. HÉBERT. So that would reflect better than 45, area of the pool?

Admiral CRONIN. Yes, sir.

Mr. HÉBERT. Of course, it doesn't necessarily mean you send 45 percent of them?

Admiral CRONIN. No, sir; that is correct.

Mr. HÉBERT. I think—of course, a degree in engineering is a minimum degree as far as scholastic background is concerned. It is interesting to note that of all the professions, the engineer degree is the minimum, amount of 4 years. A lawyer needs 7, a doctor needs 9, and an engineer only needs 4.

Mr. COURTNEY. He only has four. He may not need four. He has in fact 4 years.

Mr. HÉBERT. That is minimum, to get a degree.

Mr. COURTNEY. Yes.

Mr. HÉBERT. To get an engineer degree, that is a bachelor of science degree. The minimum is 4 years. But a lawyer has to have 7 years and a doctor has to have 9 years. I am talking about the professions.

Admiral CRONIN. Yes, sir.

Mr. HÉBERT. Those are the minimum requirements.

Now, in the overall picture, as I understand it, you have difficulty obtaining scientists and engineers for the Navy.

Admiral CRONIN. Yes, sir: that is correct.

Mr. HÉBERT. And the difficulty is reflected in the lack of adequate compensation?

Admiral CRONIN. We believe that is the primary cause, yes, sir.

Mr. HÉBERT. If that was eliminated, you don't feel you would have any difficulty?

Admiral CRONIN. I don't believe we would have nearly so much difficulty as we have had, yes, sir.

Mr. HÉBERT. The reason for that question is to learn whether or not there is a lack of supply of engineers and scientists. Would you say there is a lack of supply?

Admiral CRONIN. Yes, sir. As I said, it appears that that lack is not quite as severe as it was a few months ago. Recently there appear to be indications that there is not as great a lack as there was several months ago.

Mr. HÉBERT. And you think that is reflected by the cutting down in industry?

Admiral CRONIN. Yes, sir. But that, of course, can change any time.

The main point is, though, that in any event we are not in a position to compete with industry because of our lower salaries and industry, of course, has an opportunity to get the cream of the crop, so to speak, as compared to the Government.

Mr. HÉBERT. But if the compensation was increased, you feel that your problem would be solved?

Admiral CRONIN. Yes, sir, that is the major consideration.

Mr. HÉBERT. What other considerations?

Admiral CRONIN. The other considerations are the—I believe we would improve our recruitment ability if we were able to pay travel and transportation to the point of interview, that is pay travel to point of interview for the prospective employee.

Mr. HÉBERT. That again, is competitive with industry?

Admiral CRONIN. That is right, because industry, generally speaking, does that.

Mr. HÉBERT. And also compensates for housing and removal of families, and so on.

Admiral CRONIN. That is right, yes, sir.

Then if we were able to eliminate the ceiling on the high-level positions in the engineering and scientific fields.

Mr. HÉBERT. You mean in numbers?

Admiral CRONIN. In numbers, yes, sir, that would permit us to put into the Public Law 1028 positions some of those who are now in GS–15 and that would, I believe——

Mr. HÉBERT. That was the question I asked a little ago: You needed so many 10's, 11's and 12's, and the Civil Service says you can't have them but you need them. You may not need any 7, 8 and

9's, but you need 10, 11 and 12's, but you can't take them because you are prohibited.

Admiral CRONIN. We have a limitation established by law on the total number of Public Law 1028 positions, and if that were eliminated then we would be able to put more of our top level engineers into those positions.

Mr. HÉBERT. What is that limitation? What does it say, for the record?

Admiral CRONIN. At the present time the Navy has 35, sir.

Mr. HÉBERT. 35 what?

Admiral CRONIN. Of these positions.

Mr. HÉBERT. The Navy can only have 35, under public law what?

Admiral CRONIN. Public Law 1028.

Mr. COURTNEY. Well, that is GS what and above?

Admiral CRONIN. It is not a schedule rate, sir. The rate is determined by the agency with the permission of the Commission, with the concurrence of the Civil Service Commission.

Mr. COURTNEY. Well, there must be a base in there of some kind.

Admiral CRONIN. Yes, sir; the top limit is $19,000 a year.

Mr. COURTNEY. Well, what is the beginning, to come under the law? Would you like to supply that for the record?

Admiral CRONIN. The salary range within which Public Law 1028 positions may be established is $12,500 to $19,000 per annum.

Mr. COURTNEY. $19,000 is the top. And with a limitation of 35?

Admiral CRONIN. That is correct.

Mr. COURTNEY. Actually, Admiral, in your prepared statement, and I refer back to it, you placed some emphasis on the GS–13 bracket, which is somewhere around $9,000—between $9,000 and $10,000, depending on the length of the period in service.

Admiral CRONIN. Yes, sir.

Mr. COURTNEY. Now, as a practical matter, Admiral, in the administration of the Navy Department itself—I don't know where it stems from—isn't it a fact that the number of position in grade are limited by quota?

Admiral CRONIN. No, sir; they are only limited by approved organizations.

Mr. COURTNEY. By approved organizations?

Admiral CRONIN. Yes, sir.

Mr. COURTNEY. Let's take a specific case. Take the White Oak Laboratory out here.

Admiral CRONIN. Yes, sir.

Mr. COURTNEY. Now that is set up for a specific function or a series of functions.

Admiral CRONIN. Yes, sir.

Mr. COURTNEY. Would we understand, then, that when that organization is set up, that some place other than within the Navy or within the Civil Service Commission—I am going to ask you to explain it—there would be an allocation of that function to that organization or that institution the grade of the civil servants in this category of technically trained people who would man it.

Admiral CRONIN. The Navy would do that themselves, sir. The Navy would approve the organization which the commanding officer has set up and the duties of the various people in the positions in that organization. Then those positions would be allocated certain grade

levels, which would be approved by the commanding officer, with the Civil Service Commission later looking in as I indicated.

Mr. COURTNEY. Well, then, let me understand you. The commanding officer, whoever is in charge of this laboratory, would set up what he proposed to do in numbers and functions?

Admiral CRONIN. Yes, sir, that is right.

Mr. COURTNEY. And he would describe, then, the job classification?

Admiral CRONIN. He would describe the positions, yes, sir.

Mr. COURTNEY. He would describe the position in the job classification that he would want to have filled, is that right, in order to make this place operate?

Admiral CRONIN. Yes, sir; that is right.

Mr. COURTNEY. Performance function, is that right?

Admiral CRONIN. That is very close, yes, sir.

Mr. COURTNEY. Well, get me a little closer.

Admiral CRONIN. He makes organization charts up and places the duties of the various branches, sections and divisions to fulfill the mission that is assigned to the laboratory.

Then, a description of any one of those duties is what determines what the grade level of the position is. Now he makes that determination by using his occupational analysis people. And his management bureau, in this case the Bureau of Ordnance, could well say, "We want to restrict that position, that is, want to restrict those duties to a certain level. We don't want them any higher than a GS–12 because of the responsibilities that we feel this job should have."

So the management bureau has some control over——

Mr. COURTNEY. Navy management bureau?

Admiral CRONIN. Yes, sir; Bureau of Ordnance in that case.

Mr. COURTNEY. You mean the managing bureau, rather than some other bureau in control?

Admiral CRONIN. That is right.

Mr. COURTNEY. But in the final analysis, let me say, again, if I am correct; wouldn't the Civil Service Commission have the authority to come in and regrade those positions after examining the job classification and the work done by the individual?

Admiral CRONIN. Yes, sir. On their review, the Civil Service Commission could make a determination that the position was not properly allocated.

Mr. COURTNEY. Properly allocated: By that would you mean that the individual occupying it was not doing what he was hired to do?

Admiral CRONIN. No, sir.

Mr. COURTNEY. Or that the job was not required?

Admiral CRONIN. That the duties that he was performing were of a higher or lower grade than had been assigned to it.

Mr. HESS. Well, can that be changed from time to time?

Admiral CRONIN. Oh, yes, sir.

Mr. HESS. The number in the various classifications.

Admiral CRONIN. We make an annual review for that purpose, to be sure it is correct.

Mr. HESS. Well, let's say the commanding officer of some particular installation, after it has been set up and he has had a certain number in each grade, and, say, he has some added duties given to him.

Admiral CRONIN. Yes, sir.

Mr. HESS. Maybe research and development, or something of that kind.

Admiral CRONIN. Yes, sir.

Mr. HESS. Could he then request that there be an additional number in such and such a grade, or that some in the lower grade be eliminated and their places taken by more in the higher grades?

Admiral CRONIN. He can establish those, himself, sir, but then, of course, he would have to stay within his budget. He couldn't go off in the blue. He would have to watch his money on that. But there is nothing to prevent him from establishing the position that he needs. Unless the management bureau, again, puts some specific restriction on him.

Mr. COURTNEY. That is, his bureau chief.

Admiral CRONIN. Yes, sir. Each one of our field activities has a management bureau, one of whose primary duties is just that.

Mr. HESS. But in the final analysis, the Civil Service Commission has the last say?

Admiral CRONIN. They have the last say in regard to the level which is allocated the position, yes, sir, but not the organization.

Mr. HESS. No, but they could veto the commanding officer's assignment of the position.

Admiral CRONIN. Yes, sir.

Mr. HÉBERT. I understood you to say that you are limited by law to 35, $19,000-a-year people.

Admiral CRONIN. The Navy has been assigned that many positions. The law limits the total numbers, sir. We have been assigned—the Department of Defense——

Mr. HÉBERT. Who assigned them?

Admiral CRONIN. The Department of Defense assigned the Navy 35, sir.

Mr. COURTNEY. How many are filled?

Mr. HÉBERT. In the law, what is the total number in the law?

Admiral CRONIN. The Department of Defense is presently authorized 135 Public Law 1028 positions. This total includes 15 positions recently authorized by the Supplemental Defense Appropriation Act, 1958. The Federal Government is authorized 190 Public Law 1028 positions. This total breaks down by agencies as follows:

Department of Defense	135
National Security Agency	25
National Advisory Committee on Aeronautics	30
Total	190

Since Public Law 1028 positions are established for research and development relating to the national defense, military medicine, and other activities of the Department of Defense that require the services of specially qualified scientific and professional personnel, they are found only in the agencies listed above. It is understood, however, that similar positions for other agencies of the Federal Government are authorized by separate legislation.

Mr. HÉBERT. All right. Thirty-five are assigned. Suppose the Navy wants to have a particular mission that requires, say, two of these people. This is all theoretical. Thirty-five of them have already been assigned and they can't be released from the other duties.

Therefore, the Navy can't perform its mission in the new installation, can it, unless they are given additional people?

Admiral CRONIN. These particular positions, Mr. Chairman, have their salaries set not only on the duties, but also on the qualification of the man. So these are peculiar positions in that the salary paid depends on both the qualification of the man and the type of position.

So frequently we will find a job which is handled now by a GS–15, which could—that is the top level below the supergrades.

Mr. HÉBERT. Yes.

Admiral CRONIN. Which could be by definition assigned to a Public Law 1028 position if we had the extra spaces. So we do have men now in the GS–15 positions doing work which could be put in the 1028 jobs at a higher salary if we had those spaces available.

But the men are doing that work at the GS–15 level.

Mr. HÉBERT. They are getting shortchanged?

Admiral CRONIN. Yes, sir.

Mr. HÉBERT. And that is because of a limitation of law?

Admiral CRONIN. Yes, sir.

Mr. HÉBERT. An allotment.

Mr. COURTNEY. Are all 35 of the allocated jobs to the Department of the Navy filled?

Admiral CRONIN. I believe that they are all filled now, with the exception of probably 1 or 2. But that, of course, varies from time to time.

Mr. COURTNEY. Well, of course, there is the normal attrition.

Admiral CRONIN. There is no trouble in filling them, sir. I will say that. One or two we have had difficulty getting a qualified man on, but generally speaking, we don't have very many vacancies.

Mr. HESS. Admiral, I don't know whether you can answer this or not. You say there were 135 or 190 for the Department of Defense and they are allocated by the Department of Defense to the various services. Do you know whether all of the 135 or 190 places have been filled or whether the Department of Defense still has some that could be allocated and then filled?

Admiral CRONIN. They have all been allocated, I am quite sure, sir.

Mr. HESS. Yes.

Mr. HÉBERT. Could you use more than the 35, to the advantage of the Navy?

Admiral CRONIN. Yes, sir; that is the reason we would like to have the ceiling removed.

Mr. COURTNEY. You are speaking particularly of this scientific field?

Admiral CRONIN. That is correct; yes, sir.

Mr. COURTNEY. Or are you speaking of general administrative?

Admiral CRONIN. No, sir. These are restricted to scientific and engineering jobs.

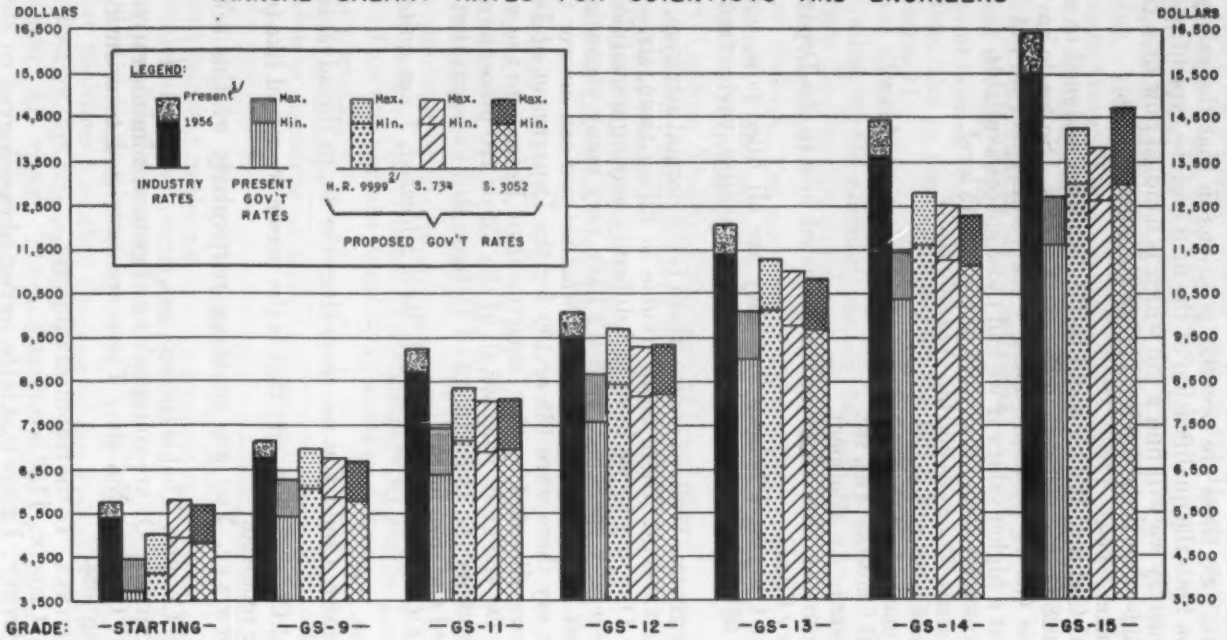
Mr. COURTNEY. To the technical subjects?

Admiral CRONIN. That is correct.

Mr. COURTNEY. I guess that is the correct phraseology.

Admiral CRONIN. That is correct.

PRESENT INDUSTRY AND PRESENT AND PROPOSED GOVERNMENT ANNUAL SALARY RATES FOR SCIENTISTS AND ENGINEERS



1/ Difference between 1956 rates (Cordiner Study) and estimated present rates based on increases reflected by contrast of 1956 and 1957 Los Alamos Studies.

2/ Lower starting salary reflected by H.R. 9999 is due to fact that S. 734 and S. 3052 authorize use of GS- 7 as starting grade.

Mr. COURTNEY. Now, Mr. Chairman, Adm. M. E. Dornin is here. He has graduated from Capitol Hill.

Mr. HÉBERT. He got his degree here.

Mr. COURTNEY. He got his degree here, we think.

Admiral, will you proceed in your own way.

Admiral DORNIN. Glad to be here.

Mr. COURTNEY. Mr. Chairman, the Admiral has a very complete prepared statement and a report which I would like to have inserted in the record.

STATEMENT OF REAR ADM. M. E. DORNIN, ASSISTANT CHIEF OF NAVAL PERSONNEL FOR PLANS

Admiral DORNIN. I have a statement which summarizes the report, but with your indulgence I will summarize the summary in the interest of saving time. It is a great pleasure for me to appear before this subcommittee, at the invitation of the distinguished chairman, to report to you regarding technological, scientific, and engineering personnel in the Navy. The committee counsel has been provided previously with copies of this more detailed 23-page report. It is respectfully requested that this report be inserted in the record of proceedings. With the permission of the distinguished chairman I will confine my remarks to a general brief of this report. Upon the conclusion of my prepared statement I shall be most happy to answer any questions the members of this committee may desire to ask.

Historically, the Navy has been a technical service utilizing complex weapons and weapons systems to prosecute naval warfare. In order to support this technological fleet, it has been necessary to maintain a considerable effort in the field of education for both officers and enlisted personnel. The very nature of the weapons systems now in use and those projected for future use dictates that a major share of this effort be devoted to engineering fields. However, as systems have become more refined, the need for greater emphasis in the physical sciences has become more pronounced and the educational effort has been modified to respond to this need.

Known and projected requirements form the basis for educational planning. Generally speaking, the education of officers is carried out at the graduate level. Annually all officer billets in the Navy are reviewed and requirements for specific education are collected by the Bureau of Naval Personnel. From this basic information a determination is made regarding the numbers of officers to be sent to school and the particular subject matter they will study. In January of 1956 a board was convened to study the Navy's entire postgraduate educational program resulting in planned annual increases that will effectively double the officer inputs to scientific and engineering education by 1961. The extent of this expansion can best be illustrated by comparing the entering numbers for 1957 and the planned inputs for this coming fall. In the physical sciences the 1957 input was 85 officers while the 1958 planned figure is 215. In engineering, the increase will be from 448 to 527.

Mr. HÉBERT. Admiral, you are speaking of the man in uniform, an officer?

Admiral DORNIN. Yes, sir.

Mr. HÉBERT. An officer?

Admiral DORNIN. Yes, sir. We have other programs for enlisted personnel.

Mr. HÉBERT. And you are speaking of the postgraduate courses?

Admiral DORNIN. Postgraduate, I am, sir.

Mr. HÉBERT. And you say you are 900 shy, or 2,100 as against 3,000 needed?

Admiral DORNIN. Yes, sir.

Mr. HÉBERT. Two thousand one hundred aboard and objective 3,000. So you are 900 shy?

Admiral DORNIN. Yes, sir.

Mr. HÉBERT. Now, why is that, if you have the graduates coming from the Naval Academy and the so-called Holloway plan, in institutions throughout the country.

Admiral DORNIN. Those graduates only have their baccalaureate degree. They do not have postgraduate degrees.

Do I understand your question correctly, Mr. Chairman?

Mr. HÉBERT. No, I probably was not clear. I was addressing myself to the baccalaureate degree all the way through, and starting with that basis and then projecting that into the postgraduate courses.

Now, I understand now from your reply that you would indicate that you need 3,000 masters or 3,000 above the baccalaureate degree?

Admiral DORNIN. That is correct, sir.

Mr. HÉBERT. And you are now trying to approach that figure?

Admiral DORNIN. We have 2,100 aboard and, as you say, 900 short, sir, and by the end of about 3 years, with 450 enrolled this year, and 530 next year, we will well meet our requirement within 2 or 3 years, depending on the length of courses these people pursue. And as, of course, we go further in nuclear power and guided missiles, our requirements will go above 3,000, undoubtedly.

Mr. HÉBERT. You will also tag behind, then?

Admiral DORNIN. Not very far, I don't think.

Mr. HÉBERT. Then you are satisfied with the progress of the postgraduate?

Admiral DORNIN. I feel we are.

Mr. HÉBERT. All right.

Admiral DORNIN. Because we will increase our program by 100 percent in the next 5 years.

Mr. HESS. When did you start building it up, Admiral?

Admiral DORNIN. In 1956, the Board study was held and we started in 1957 building up.

Mr. HESS. There has been a gradual buildup since then?

Admiral DORNIN. That is correct.

Mr. HESS. And that will continue?

Admiral DORNIN. That will continue, sir.

Mr. HÉBERT. You send these individuals to private schools or to—where do they get their postgraduate work?

Admiral DORNIN. Well, we have our postgraduate school at Monterey, in which most of them start, the first year, and they can continue there or go to various other schools of higher learning.

Mr. HÉBERT. Monterey is the naval school?

Admiral DORNIN. Yes, sir; the postgraduate school or naval school, and from there they go to the normal institutions of higher learning.

Mr. COURTNEY. Admiral, on that subject, what is the highest degree or what is the highest degree of training at the Monterey School?

Admiral DORNIN. You can obtain a doctorate normally there, and a master's.

Mr. COURTNEY. But normally you stay within the master's range. However, it is qualified to give doctorate degrees?

Admiral DORNIN. That is correct.

Mr. COURTNEY. And that relates particularly to scientific matters, such as we have been speaking of here today, and not general administrative degrees?

Admiral DORNIN. Right.

Mr. HÉBERT. Are these individuals selected to go to the graduate school—are they selected or directed?

Admiral DORNIN. They are selected. They request this training.

Mr. HÉBERT. It originates with the individual?

Admiral DORNIN. With the individual and our selection board just finished last month for the next fiscal year. These people are also sponsored by the various bureaus and offices in the Navy Department.

Mr. HÉBERT. It is based on selection?

Admiral DORNIN. The bureaus tell us, in the Bureau of Naval Personnel, there are requirements. We resolve them with the overall picture, as to money and facilities, and then the numbers we can take—they are selected to those numbers.

Mr. COURTNEY. In the final analysis it is selection?

Admiral DORNIN. It is selection.

Mr. HÉBERT. All right; proceed.

Admiral DORNIN. While the need for officers capable of planning and supervising the use of this complex fighting machine has expanded, there has been a concurrent increase in requirements for technical enlisted personnel who must actually operate, maintain, and repair this machine. As with officer education, enlisted billets requiring rated or specialized personnel are reviewed annually and the number of personnel ordered into training programs is based upon this review.

For any given year the demands of various segments of the Navy for education and training will exceed that which can be supported without seriously affecting the operating forces. So long as the Navy must be continually ready to fight in widely scattered areas of world tension, the operating forces cannot be whittled away to support education other than that which is absolutely essential. As always, a logical balance must be struck between what is desired and what can be afforded. For this reason priorities are assigned to the various fields of education and training. The leading priorities currently are assigned to missiles, nuclear power, antisubmarine warfare, and communications. Where training cannot wait for the installation of equipment at a formal Navy school, both officer and enlisted personnel are sent directly to factories to learn the equipment as it is being produced. At the moment this is particularly true of the Polaris fleet ballistic missile program.

For all of the above education, the annual review includes a 5-year projection of the requirements. Copies of these annual plans are available for committee perusal if desired but have not been included in the detailed statement due to their bulk.

Officer personnel sources fall into two main categories, namely, career and noncareer. The primary sources for the Regular Navy, that is career officers, are the Naval Academy and the regular component of the Naval Reserve Officers Training Corps. Secondary sources include Reserve to Regular augmentation, enlisted to officer integration, and the limited-duty officer programs. The Reserve or noncareer officers stem from the contract NROTC, Officer Candidate School, naval aviation cadet, and similar programs. The quality of naval officer personnel is considered to be excellent. Except for the naval aviation cadet, limited-duty officer, and enlisted integration programs, all officers possess a baccalaureate degree when commissioned. It should be noted that a portion of the total educational effort of the Navy is devoted to raising some officers of lesser education to the baccalaureate level. Of course, all Naval Academy graduates possess engineering degrees and more than 50 percent of al. NROTC graduates hold degrees with either physical science or engineering majors.

Mr. HÉBERT. Incidentally, in that area, in recent months, certainly within the year, for your naval ROTC students in various private or State universities, as I understand it, the curriculum has been changed to limit it to scientific studies; is that correct?

Admiral DORNIN. Not only that but we have increased our requirements in mathematics, physics, and chemistry. We don't limit them yet, but we have——

Mr. HÉBERT. As I understand, for instance, an individual, an NROTC, can't take law?

Admiral DORNIN. Well, there are certain majors that he can't take.

Mr. HÉBERT. Law is one of them?

Admiral DORNIN. Medicine, dental, law—I forget what the others are. That is correct.

Mr. COURTNEY. That is another training program?

Admiral DORNIN. That is correct.

Mr. HÉBERT. That is different. But the individual who is in the Holloway plan cannot take a major in law, dentistry, or medicine.

Admiral DORNIN. Animal husbandry—I mean all those fancy courses.

Mr. HÉBERT. All those fancy names. Anyway, it is the scientific course they are limited to in the curriculum.

Admiral DORNIN. We try to limit it to that; yes, sir.

Eighty percent of all enlisted personnel are recruited directly from civilian sources while the remaining 20 percent are obtained from the Naval Reserve. All are volunteers. Over the past few years the mental caliber of the incoming recruits has shown steady improvement. For the first half of fiscal year 1958 some 58 percent were considered capable of completing technical training school. In this day of increasing complexity it is considered that the target percentage should be about 75 percent.

Mr. HÉBERT. What is the obligated service of the Holloway graduate?

Admiral DORNIN. He has 3 years. And the ones coming in now will have 4 years.

Mr. HÉBERT. The ones coming in now will have four. That is the same as the Academy, it is changed to?

Admiral DORNIN. That is correct.

Mr. HÉBERT. Fine.

Admiral DORNIN. We didn't want to break a contract and change it right in the middle of the stream.

Mr. HESS. It is 4 years in the Academy.

Mr. HÉBERT. Four years in the Academy and 4 years obligated service. Heretofore it has been 3 and now increased to 4. Air Academy is 5. They had 3, but it will be 4 in the future.

Admiral DORNIN. For those that are entering now, that is correct.

Mr. COURTNEY. Admiral, are those filled that are under the Holloway plan?

Admiral DORNIN. Yes; we have quotas filled. For some 1,800 vacancies we had some 27,000 applications this year.

Mr. HÉBERT. What is that for?

Admiral DORNIN. For the Holloway plan. We have a very fine selection for this program.

Mr. HÉBERT. Have you found that program successful, Admiral?

Admiral DORNIN. We consider it very successful. We would like to have a little higher retention rate than we are getting, as you all know.

Mr. HÉBERT. That is what I was addressing myself to.

Admiral DORNIN. We would like to have 25 to 30 percent. Of course, we don't want too much, because we want these people to go into the Naval Reserve to staff our Naval Reserve. But right now we are getting between 16 and 20 percent, and we would like to get 25 percent.

Mr. HÉBERT. What is your percentage of retention at the Naval Academy?

Admiral DORNIN. It runs about 80 percent. I don't mean over the long haul, but when the boys complete their obligated service we keep about 80 percent.

Mr. HÉBERT. And in the Holloway plan you only keep about 17?

Admiral DORNIN. It runs between 16 and 20 percent.

Mr. HÉBERT. Sixteen and twenty percent.

Admiral DORNIN. It is approaching 20.

We keep more of the Holloway people that go into Naval Aviation than don't, which indicates there is an economic problem there, I think, that we hope the pay bill will take care of.

Now, to education and training programs. With regard to officer education, the problem is complicated by those officers of each Regular Navy year group who do not possess a college degree. The five-term program is designed to alleviate this situation and, of course, any improvement in NROTC retention rates will assist also. In addition, some officers are ordered to the General Line School for professional education designed to place them on a par with those who were given 4 years of midshipman training. Basically, all of the above is undergraduate study.

By far the largest segment of officer education is involved in graduate level work. This education generally is conducted either wholly at the Naval Postgraduate School at Monterey, Calif., or in part at Monterey with terminal studies at selected civilian universities. A few curriculums are conducted in their entirety at civilian institutions. In addition to courses in all fields of engineering and science that are pertinent to Navy needs, the postgraduate program includes a group of curriculums entitled "Advanced Science." Included are studies in nuclear physics, general physics, chemistry, metallurgy, applied mathematics, and hydrodynamics. Officers enrolled in these

courses are being trained in theoretical rather than applied studies and will provide the required link between the civilian research scientist and the seagoing naval officer. It is anticipated that some of these officers will follow an unrestricted line-type career and eventually be utilized in highly technical command assignments.

To meet the technical enlisted personnel requirement the Navy maintains numerous training schools of various levels. Individual progression through these levels is mixed with fleet assignments to produce technical experts in particular skills. In 1955 it became apparent that increased enlisted competence would be required to effectively utilize advanced fire control systems, digital computers, and similar technological developments. Accordingly, in 1956, the Navy enlisted advanced school program was inaugurated at Purdue University. Highly selected enlisted personnel were enrolled in electrical engineering curriculums with special courses covering various new equipments and systems. In 1957 this program was expanded to include the University of Washington and there are 135 enlisted men currently enrolled with a subsequent planned annual input of 100.

Interestingly enough, the men at Purdue are getting higher marks than the regular Purdue student. And, strangely enough, the married enlisted man is getting higher marks than the unmarried. [Laughter.]

The program consists of 2 years at school, 2 years in the field or at sea in a naval assignment, 2 more years at school, and then a final 2 years in the field.

Two, two, two, two, is the program.

Mr. HÉBERT. Six years to complete the course.

Admiral DORNIN. Well, it is 1 for 1 payback, actually.

Mr. HÉBERT. Don't you have another program at Purdue for retired personnel?

Admiral DORNIN. At Purdue we do. It is not run by the Navy. It is run by the University of Purdue.

Mr. HÉBERT. For retired naval personnel?

Admiral DORNIN. Yes, sir.

In addition to this Navy enlisted advanced school program that I have just mentioned, we have just inaugurated another program that might seem similar in that the sources are the same, that is, enlisted personnel, but it is directed toward an engineering degree for these people.

The Purdue program that I mentioned earlier, Purdue and Washington, is to bring up more of a technician type. And these people will be commissioned, that is, offered commissions at the end of their training.

Mr. HÉBERT. Do they get degrees, too?

Admiral DORNIN. That is up to them, sir. They are on their own.

This new program, the Navy enlisted science and engineering program, consists of 4 or more continuous years of college and will produce engineers and scientists for the Navy and the Nation. They are required to stay in 4 years after that. They will be commissioned on graduation and we hope they will stay with us for a long time.

In September 1958, the first 200 students will be enrolled in the recently approved Navy enlisted science and engineering program. This program will build up to an annual input of 500 enlisted men by calendar year 1961.

Mr. HÉBERT. You say you hope. Are you speaking now of drawing from the enlisted personnel, the enlisted man, the noncommissioned man?

Admiral DORNIN. We are.

Mr. HÉBERT. And paying for his education?

Admiral DORNIN. We are.

Mr. HÉBERT. And hoping that he is going to stay?

Admiral DORNIN. We are requiring him to stay 4 years.

Mr. HÉBERT. That is what I mean.

Admiral DORNIN. We are requiring him to stay 4 years and hope he will make a career of it.

Mr. HÉBERT. I understand. Fine.

Admiral DORNIN. Incidentally, on these 2 programs, with only an input of 100 in 1 and 200 in the other annually, we have received over 6,000 applications for this and over 2,000 from the Marine Corps as a matter of fact.

Mr. HÉBERT. In other words, Admiral, as I understand it, the Navy has three educational programs in progress. Of course at the top of the list is the Naval Academy itself.

Admiral DORNIN. That is correct, sir.

Mr. HÉBERT. No. 2 is the so-called Holloway plan.

Admiral DORNIN. That is correct.

Mr. HÉBERT. And No. 3 is to give the enlisted individual an opportunity.

Admiral DORNIN. That is right. The enlisted personnel also can apply for the Holloway plan or the Naval Academy, Mr. Chairman, too.

Mr. HÉBERT. I think it is a magnificent program that you have. You are looking forward.

Admiral DORNIN. We feel it will go great things for us, with the coming of the technical age.

Mr. HÉBERT. Because you can take the enlisted man out of the fleet who has ambition and talent and send him to a university and get a degree, and obligated 4 years additional, and with the hope he will stay on.

Admiral DORNIN. And most of them will have from 1 to 3 years of prior enlisted service, so they will have had 11 years equity in service and we think we will have a very high retention rate.

Mr. HESS. Let me ask you, going back to this enlisted boy who goes to Purdue for 2 years, and then goes back to sea and then comes back for 2 years. Let us say, for example, he enlisted for a 3-year hitch and just at the end or the completion of that 3 years he is selected to take a course at Purdue. Does he sign up then for 4 years additional, 2 years for school and 2 years for service?

Admiral DORNIN. That is correct. He has to extend his enlistment.

Mr. HESS. Has to extend his enlistment for 4 years. If he decides to go out of the Navy at the end of that 4 years he may; is that correct?

Admiral DORNIN. Yes, sir.

Mr. HESS. Or he can take another 4-year hitch and complete his education?

Admiral DORNIN. That is right.

Mr. HESS. And spend 2 more years in the Navy after he has gotten his degree and completed his education?

Admiral DORNIN. That is correct, Mr. Hess.

Mr. HÉBERT. And a commission, as well.

Admiral DORNIN. That is correct. We do not let them get away from us without paying back for their education. They sign the enlistment agreement.

Mr. HÉBERT. That is very important.

Mr. HESS. I think it is an excellent program.

Mr. COURTNEY. And all of these programs are oversubscribed?

Admiral DORNIN. That is correct. We have not run our selection on this new program yet, but it is oversubscribed.

Mr. COURTNEY. Whether your criteria will be met is another matter.

Admiral DORNIN. We have over 6,000 applications for 300 holes.

Mr. HÉBERT. There is no lack of desire, then, to be a scientist or an engineer, or further education in science.

Admiarl DORNIN. No.

Mr. COURTNEY. Within the uniformed service.

Mr. HÉBERT. Within the Navy. I don't know about the other services. We are talking about the Navy, now.

Admiral DORNIN. That is correct.

Mr. HÉBERT. So as I understand it now, for this enlisted program you have 6,000 applicants, for how many spots?

Admiral DORIN. Three hundred, sir.

Mr. HÉBERT. For 300. You got 27,000 applicants in the Holloway program——

Admiral DORNIN. For 1,800 slots.

Mr. HÉBERT. For 1,800. Of course, there is no way of telling how many you got for the Naval Academy.

Admiral DORNIN. We have over 200 enlisted applicants—we have between 200 and 300 enlisted applicants for the Naval Academy for this year.

Mr. HÉBERT. For how many berths?

Admiral DORNIN. 160, sir.

Mr. HÉBERT. 160. That almost runs even; then, for your appointment group there is no way of telling because you get your 5 alternates backing up your principal, and there is no telling how many applicants the appointive source, that is the Member of Congress, receives before he puts in his 5. So there is no telling.

That is a rounded-out program.

Admiral DORNIN. That just about covers the main points, sir.

The primary differences between these programs are as follows:

The Navy enlisted advanced school program consists of 4 years of college broken by an intervening 2-year tour with the operating forces and produces highly skilled technicians.

The Navy enlisted science and engineering program consists of four or more continuous years of college and produces engineers and scientists for the Navy and the Nation.

All of the above schooling is undergoing continual scrutiny and revision to incorporate the latest advances in technology as they affect naval weapons. Only in this manner can the Navy hope to keep abreast of the revolutionary developments that are currently taking place.

Having once acquired and trained the people needed to meet these requirements the added problem of retaining this product presents itself.

In recent years the retention rates from the two primary sources of Navy career officers have been as follows: The Naval Academy, 80 percent; the NROTC, 20 percent.

It must be remembered that a basic purpose of the NROTC is to provide a continuing input to the Naval Reserve and that the present size of the Navy dictates an optimum retention rate of 25 to 30 percent.

Inasmuch as the remaining procurement sources are designed to provide short-term officers, their retention rates are not considered significant.

Graduate level education carries added obligated service requirements to insure a just return to the Navy for the expense involved. Retention rates among these officers is extremely high. The fact that 50 percent of last year's selections for flag rank were officers with technical postgraduate education is evidence of the high retention rate and the ever-increasing importance being attached to advanced education.

The retention rate as it pertains to enlisted personnel is less encouraging. Career personnel reenlistments are currently averaging about 85 percent. First-term reenlistments, although the rates have been more than doubled since 1955, are still at an unacceptably low figure of 13 percent. The resultant large turnover of basically trained, high potential personnel is extremely costly. The cost in time, money, men, facilities, and materials of constantly replacing and training these men imposes a heavy drain on Navy resources. The Navy is continuing its efforts to solve this problem by various means and progress is being made.

I now come to the point of evaluating our position with respect to current and foreseeable requirements. In the present time of austere manpower ceilings, care must be taken that the personnel and funds which are devoted to educational efforts do not adversely affect the operating forces. In view of the current ceiling, the educational endeavor is considered to be optimum. An increase in the size of this effort is highly desirable but is not feasible without an increase in overall Navy strength. We shall continue our efforts to adjust and revise the entire program to obtain the maximum benefit from the available resources.

This adjustment and revision includes the following specific actions currently operating to increase our engineering and scientific potential.

1. A planned increase in magnitude accompanied by continuous review of the Navy's postgraduate educational program. Inclusion of new courses of study to support new weapons and developments.
2. Increased emphasis on science and engineering in both the NROTC and five-term programs.
3. More stringent restrictions on academic majors eligible for Officer Candidate School.
4. Revision of enlisted training courses to eliminate all but essential material.
5. Introduction of a greater degree of specialization at the lower petty officer levels.
6. Inauguration of the NEASP and NESEP programs.

The success of the Navy's program of education and training in the scientific, technical, and engineering fields is dependent upon the availability of sound and imaginative leadership, excellent planning, qualified personnel, adequate funds including those required for equipment and physical facilities, and the availability of sufficient training time to permit officers and men to engage in educational pursuits. Outstanding judgment must be exercised in resolving the continuous conflicts that exist between requirements and the ability to meet them. This condition becomes increasingly serious at this time when greater emphasis on scientific and engineering fields demands an allocation of additional numbers of billets to education and training programs.

In summary, the Navy feels that all things considered, our ability to cope with the scientific age is equal to our ability to cope with other serious problems faced in these days of international tensions, extended operational commitments and austere personnel and funding ceilings. We are constantly endeavoring to increase our efficiency and combat readiness. We feel we have the means and methods by which, given proper funds and personnel, the United States Navy will continue to be the world's most potent force afloat and an important deterrent to all-out war as well as cold war limited aggression.

We think with these new programs and the ones we have in being that we are in pretty good shape, speaking of scientific and engineering talent, and will be able to keep the Navy well ahead of the game in the future.

Mr. HÉBERT. You are satisfied, then, with your pool, your scientific pool, from which you are producing the finished product?

Admiral DORNIN. Yes, sir; we are.

Mr. HÉBERT. Thank you very much, Admiral.

(The report submitted by Admiral Dornin is as follows:)

REPORT ON DEPARTMENT OF NAVY POLICY AND PROCEDURES CONCERNING THE SHORTAGE OF TECHNOLOGICAL, SCIENTIFIC, ENGINEERING PERSONNEL AND EDUCATION IN THE ARMED SERVICES WITH PARTICULAR REFERENCE TO NEW DEVELOPMENTS AREAS, SUCH AS GUIDED MISSILES, TO COMMITTEE ON ARMED SERVICES, HOUSE OF REPRESENTATIVES, BY BUREAU OF NAVAL PERSONNEL, MARCH 17, 1958

A. REQUIREMENTS

1. Scientific and engineering officers

(*a*) *Concept of graduate education.*—Graduate level officer education in the Navy is assigned and administered for the sole purpose of meeting Navy needs for such education. The Navy's need is satisfied through the supplying of a given amount of education in any particular field and the attainment of a degree is, of itself, not a Navy requirement. Rather it serves as a desirable incentive feature for the individual. The very nature of naval weapons systems dictates that the major effort be made in the field of engineering and this is the case. Eighty percent of the planned fiscal year 1959 educational input will be in the combined fields of engineering and the physical sciences; 52 percent of the planned input being in engineering alone.

Generally speaking, graduate level engineering education serves a twofold purpose in the Navy. First, it provides officers to the fleet who are equipped to supervise the operation of increasingly complex weapons systems that are continually being developed. Secondly, it provides officers for engineering-duty-only designations. The latter officers are qualified for billets involving supervision of research and development, design, construction, repair, maintenance, and material control of naval aircraft, ships and weapons systems and they provide the necessary link between the contractor and the operating forces.

The physical science curricula under the Navy's postgraduate educational program provides officers with scientific fundamentals and theory. These offi-

cers are qualified for duties involving supervision of naval research, operational and technical programs where personal contact with civilian scientists is essential.

(*b*) *Projected requirements.*—The projected requirements over the next 5-year period for trained scientific and engineering naval officer personnel are:

Field:	*Number of billets*
Scientific	527
Engineering	2,445

(*c*) *Today's officer education level in the scientific and engineering fields.*—The numbers of naval officers on active duty who are known to possess graduate degrees in these fields and who, subject to considerations of rank and code designator, may be qualified to fill the foregoing billets are:

Field	Doctor of Philosophy	Master	Total
Scientific	28	324	352
Engineering	14	1,853	1,867

(*d*) *Today's training pipeline in the scientific and engineering fields.*—The following numbers of naval officers are in the training pipeline in graduate scientific and engineering curriculums from 2 to 4 years' duration:

Field	Fiscal year 1958 enrollment	Planned fiscal year 1959 enrollment
Scientific	85	215
Engineering	448	527

2. Technical enlisted personnel

The Navy has an ever increasing requirement for technical enlisted personnel in the fields of electronics, electricity and nucleonics. A look at the past and an estimate of future requirements indicates that this increase may be expected to continue for the foreseeable future.

A prime example is seen in a comparison of the Navy's firepower yesterday and tomorrow. In the past it consisted in the main of projectiles firing from guns, both from ships and aircraft. The gunners mate was the rating primarily involved and he was a mechanic rather than a technician.

Nowadays we are rapidly shifting from guns and projectiles to guided and ballistic missiles. The rating primarily involved here is the guided missileman, a technician in the true sense. He must be extensively trained in electronics and electricity.

This analogy may also be used for numerous other ratings; the torpedoman and the new electronic torpedoes; the nuclear weaponsman who is also replacing the old gunners mate; the sonarman and the much more complicated equipment he must operate and maintain.

A comparison of numbers alone would be misleading since in many cases we may require the same number of men in a rating as in the past, but the knowledges and skills and the training required have increased tremendously.

In other words, personnel requirements exist quantitatively and may be shown by tabulation but this is only a part of the picture as the qualitative requirements are also of particular significance. An excellent example is in the nuclear propulsion area.

This program requires an additional year of technical training in several ratings. This expanded requirement is not reflected by the number of men in any one rating. Men in various ratings are given this additional training and the expansion can only be shown by the increasing number of billets requiring this training.

Based on the billets requiring rated or other specialized personnel, enlisted requirements plans are prepared on a 5-year basis and revised periodically, but not less often than once annually. The number of personnel entered into training

programs is based on these requirements plans. (A sample copy of one of these requirements plans is available for committee perusal if desired, but, because of its classified nature and bulk, it has not been made a part of this statement.)

3. Determination of requirements

(*a*) *Officer.*—The varied functions performed within the Navy generate a total need that covers almost the entire educational spectrum. The determination of this need is an annual project that is accomplished as follows. Every officer billet in the Navy has a sponsoring activity. For instance, the Office of Naval Research sponsors research and development type billets within the purview of the Office of Naval Research.

The Bureau of Ships sponsors billets within that Bureau as well as many billets in naval shipyards.

The Office of the Chief of Naval Operations sponsors fleet billets.

Annually all sponsoring activities review their assigned billets and identify those that require graduate level education. Armed with this information, the Chief of Naval Personnel computes the magnitude of the educational effort required for the year in question.

This effort is then modified in order that it may be accommodated by the numbers of personnel and by the funds that are available to support this required effort. Detailed long-range officer training plans are prepared periodically to reflect requirements for education and training and for special programs, such as guided missiles.

(Sample copies of these plans are available for sighting by the committee, but because of their bulk, are not made a part of this statement.)

(*b*) *Enlisted.*—The multitude of technical functions which must be performed within the Navy generates a total need that very nearly encompasses all the technical skills which are to be found in the skilled manpower work force of the Nation. For example, the skills which must be performed on a single destroyer by 220 men can be identified with more than 600 civilian worker skills.

The determination of this need is an annual project which is accomplished as follows: Every billet in the Navy has a sponsoring activity. Annually these sponsoring activities review their assigned enlisted billets to determine the technical level of training which an enlisted man must possess in order to be able to effectively perform all the functions of his billet.

Armed with this information, and other data such as retention rates, percentages in the various mental groups being obtained by recruiting, recruiting rate, on board strengths in the various rates and ratings, new developments and other pertinent information, the Chief of Naval Personnel computes the number of enlisted personnel and the level of technical training required for the year in question.

This is accomplished for all ratings, but currently emphasis is being given to the guided missile, antisubmarine warfare, nuclear power, and communications fields. These areas involve highly technical ratings such as electronics technician, fire-control technician, guided missileman, nuclear weaponsman, communication technician, sonarman, boilerman, radioman, radarman, interior communication electrician, and electrician's mate.

This requirement is then balanced against the numbers of personnel and the funds which are available for its support. Inasmuch as the entire enlisted technical level requirement cannot be met by Navy operated facilities, a portion of this training, particularly in new developments, must be accomplished at factories engaged in the manufacture of complex new equipment and in civilian institutions of higher learning.

B. SOURCES OF PERSONNEL

1. Naval Academy and NROTC Regular program.

The primary Regular Navy procurement sources are the Naval Academy and the Regular (subsidized) NROTC program. The Naval Academy and the NROTC institutions have mutually supporting roles in the integration of these graduates in the naval service. These two major sources of entry both make definite contributions.

There is merit in the firm integration in the service of the fine but different qualities of each. It is considered that no one institution or category, or one curriculum, can provide the qualified men contributed on the one hand by the NROTC Regular graduates and on the other by the midshipmen entering the service from the Naval Academy.

2. Other

The remaining portion of each Regular year group stems from such sources as the integration program—a means whereby selected outstanding enlisted personnel of the Regular Navy can become officers, and the limited duty officer program—whereby enlisted men are appointed officers in limited duty such as gunnery, engineering, administration and other categories.

3. Reserve officers

For Naval Reserve officers, our sources are the contract NROTC program, Reserve officer candidate program, officer candidate school, naval aviation cadet, aviation officer candidate, WAVE officer candidate training and indoctrination, and through a Navy program at the United States Merchant Marine Academy and the four State maritime academies. It is to be noted that Reserve officers from these programs can and, in some cases, do, augment into the Regular Navy.

4. Quality of officer personnel

The quality of naval officer personnel is considered excellent. All graduates of the Naval Academy have baccalaureate degrees and engineering backgrounds. All graduates of the NROTC, the officer candidate school and the aviation officer candidate school also possess baccalaureate degrees.

More than 50 percent of all NROTC graduates have degrees, with academic majors in engineering, physics, mathematics, or chemistry. The sources above represent 70 percent of the regular officer personnel of the Navy. Regular officer personnel who do not possess baccalaureate degrees encompass those commissioned as LDO's (limited duty only), those enlisted men commissioned through the integration program and those naval aviators commissioned from the NAVCAD (naval aviation cadet) program.

Even in these latter categories, some of the officers so commissioned possess degrees, although the degree, itself, is not prerequisite to a commission.

5. Recruits

Enlisted personnel are obtained through direct recruiting of volunteers. Approximately 80 percent of the enlisted personnel are recruited from civilian sources for the regular naval service; 20 percent are obtained from Naval Reserve sources.

Of recruits who entered the Navy in the first half of fiscal year 1958, about 58 percent were of a mental caliber to be eligible for assignment to technical schools. This is a considerable improvement over fiscal years 1956 and 1957, when the corresponding percentages were about 41 percent and 50 percent, respectively.

In this day of increasing complexity of equipment aboard modern ships, the Navy must strive toward a target of 75 percent of enlisted personnel with a capacity to absorb highly technical training.

C. EDUCATION AND TRAINING PROGRAMS

1. Five-term college training program

The five-term college training program provides an opportunity for eligible officers to earn a baccalaureate degree at accredited institutions. Officers who have been augmented into the Regular Navy from the Reserve forces and ex-enlisted men who have been integrated into the officer corps, who do not possess a degree, can establish eligibility for this program by obtaining at least 45 semester hours credit by their own effort and by being able to obtain a degree within 5 semesters.

While officers may select any major field of study except predental, prepharmacy, premedical, pretheology, law, music or art, it was determined in May 1957 that all courses of study should include mathematics, through integral calculus, and 1½ years of physics.

In August 1958 a new program to supplement undergraduate education now being conducted at civilian universities will be implemented at the School of Naval Sciences, a component of the United States Naval Postgraduate School, Monterey, Calif. The curriculum will include the Navy-professional subjects taught in the current general line officer curriculum and sufficient coverage in the social-humanistic and scientific-engineering areas to adequately support a fully accredited bachelor of science degree.

A major advantage of this program over the five-term college training program conducted at civilian universities is that every facet of the officer's instruction will be geared to the needs of the Navy. Graduates will augment the source of input to technical postgraduate education programs.

One hundred students will be ordered to the School of Naval Sciences annually. Complete replacement of undergraduate education now being conducted at civilian universities under the five-term college training program will require additional facilities at the postgraduate school.

2. Postgraduate—Advanced science

(*a*) The United States Naval Postgraduate School, located at Monterey, Calif., is the Navy's prime facility for the graduate level education and training of naval officers. The mission of the school is as follows:

"To conduct and direct the instruction of commissioned officers by advanced education, to broaden the professional knowledge of general line officers, and to provide such other indoctrination, technical and professional instruction as may be prescribed to meet the needs of the Navy."

There are three component schools at Monterey—the engineering school, the general line school (to be redesignated school of naval sciences, effective July 1, 1958), and the Navy management school.

Providing technical and advanced scientific education is the function of the engineering school.

The resident students follow one of some 38 technical curricula of 2 to 3 years duration. Some of these curricula are given in their entirety at the engineering school, while others provide for terminal studies at a civilian institution after an initial year or two at the naval postgraduate school; a few of the technical curricula are given entirely at civilian institutions.

Officers pursuing the advanced science curricula normally commence their studies at the naval postgraduate school and culminate their education at civilian institutions.

A United States naval postgraduate school catalog for academic year 1957–58 is available for sighting by the committee, if desired.

(*b*) In 1956 the Navy's postgraduate educational program was thoroughly reviewed by a special board appointed by the Chief of Naval Personnel for that purpose.

On the basis of the findings and recommendations of this board, all graduate technical curricula were studied with a view to revising and updating them to reflect the latest technological advances in all areas, including guided missiles, ASW, nuclear power, and naval tactical data system.

Today, as in the past, the technical graduate curricula are under continuous review and revision to insure that the most advanced and widest possible scope of knowledge is available to the naval officer students enrolled in the scientific and engineering curricula under the Navy's postgraduate educational program.

(*c*) In view of recent international developments and in recognition of an immediate need for more officer personnel with an understanding of science, the Navy's regular graduate program in advanced science is being increased from a fiscal year 1958 enrollment of 6 to a fiscal year 1959 enrollment of 25.

Some 6 to 8 of these officers will be enrolled in the program at the masters' degree level to pursue doctorate level education.

The educational pursuits of this particular group of officers will be directed toward acquiring the most advanced and widest possible knowledge of the latest technological advancements, including "outer space technology."

Consistent with their academic performance, officers entering this program at the baccalaureate level will have the opportunity to continue their educational endeavors through the doctorate degree.

Steps are underway to augment the foregoing regular advanced science program with the following sources of officer personnel:

(1) Commencing in 1958, five NROTC highly qualified and motivated graduates will be enrolled annually in a special advance science program designed to emphasize space technology. These officers will be assigned directly after graduation from the NROTC program.

(2) Commencing in 1959, five Naval Academy graduates will be enrolled annually in scientific postgraduate curricula—nuclear physics, general physics, chemistry, metallurgy, applied mathematics, hydrodynamics, space technology—leading to the doctorate degree. These officers will be selected prior to graduaton from the Naval Academy; assigned to selected seagoing billets for 1 year; thence enrollment at selected civilian institutions for 3 to 4 years.

(*d*) Concurrently with the continuous updating of graduate curricula, commencing with the academic year 1957, as a result of the 1956 review of the Navy's entire postgraduate educational program, an increase of approximately 100 percent phased over a 5-year period is being effected in the input of naval officer students into the gradnate educational program.

3. Navy enlisted advanced school program (NEASP)

This program was inaugurated in 1956 because the ever-increasing complexity of technical equipment in present-day naval ships and aircraft requires a level of professional education and technical training above that afforded in the Navy's advanced service schools.

Under this program selected enlisted personnel of proven technical skill are sent to civilian institutions of higher learning where they pursue courses leading to baccalaureate degrees in electrical engineering.

In addition to the regular college degree requirements, these personnel are given special technical courses to meet specific Navy needs—digital computers, high capacity communications, missile control radar, and so forth.

Because of the current need for this new type of ability, the scheduling of this program has been made on a study-work basis in which duty-under-instruction periods of 2 years are interposed with duty assignments of 2 years in the fleet.

Upon graduation they will be offered a commission if otherwise qualified.

Presently, 135 men are enrolled in this program—47 in their first year at the University of Washington; 44 in their first year at Purdue University; and 44 in their second year at Purdue.

It is planned to enter 100 men each year into this program.

4. Navy enlisted scientific education program (NESEP)

In January 1958, in recognition of the increased emphasis on science, the Secretary of the Navy inaugurated the Navy enlisted scientific education program (NESEP).

Under this program selected enlisted personnel will be enrolled in civilian universities to pursue regular college catalog courses in scientific fields. Upon graduation they will be offered a commission, if otherwise qualified.

They will be required to serve 4 years of obligated service in return for their 4 years of college training.

It is planned to enter the first of these students, about 200, into colleges in September 1958. It is ultimately planned to enter up to 500 students per year into this program.

5. Enlisted technical

The Navy converts raw manpower into trained technicians by the following process:

(*a*) Every new man entering the Navy gets 9 weeks' recruit training. During this period, he is given various aptitude tests to determine the particular skill in which he can be most effectively trained.

(*b*) Then, those who have been selected for further technical training enter their particular class A school where they obtain basic technical knowledge and skills in a rating.

In these schools it is important that men receive sufficient technical training to enable them to be useful on the job; but it is equally important that this initial training not be extended beyond the time necessary to prepare them for fleet service.

An inordinate amount of school training delays arrival in the fleet and reduces the extent of productive period during their first enlistment. Maximum benefit must be derived from complementary training on the job.

(*c*) The next level of technical training is conducted in class B schools, which give the enlisted man advanced technical knowledges and skills in his rating. Students for these technical service schools are, in general, career petty officers.

(*d*) Another class of technical training is class C training. This training is usually designed to meet specific technical deficiencies or to provide specialization not required generally by the man's rating.

Thus, for example, a ship requiring a technician for a particular gunfire-control director, can send a man to school for a short period of time for the required training, upon completion of which he returns to his ship.

(*e*) In those cases where equipment is not available to the service schools for training, personnel are sent to factory courses conducted by the manufacturers.

(*f*) The course length and curriculum of the foregoing schools is constantly under study, and revised as necessary to best meet fleet requirements.

D. RETENTION EXPERIENCE

Up to this point there has been mentioned briefly the requirements the Navy has for scientific, engineering, and technically trained personnel, the sources

of personnel, and the education and training program designed to convert the source into the technically qualified personnel needed to meet the requirements.

Once having acquired, educated, and trained suitable personnel, it is important, of course, to retain for Navy careers a substantial proportion of these qualified personnel. The necessity for acquisition and training of personnel is directly proportional to the rate at which talented officers and men are lost. This is an area of continuing concern.

1. Officer

(*a*) In recent years the retention rates from the two primary sources of Navy career officers, Naval Academy and the NROTC regular program, have been about as follows:

	Percent
Naval Academy	70
NROTC[1]	20

[1] A basic purpose of the NROTC is to replenish the Naval Reserve contingent with seagoing experienced young officers. Therefore, a 25–30 percent career retention rate is considered to be the optimum from this program.

(*b*) Other officer sources normally provide short-term officers who serve an obligated period of 2 or more years. These officers would not be provided educational courses unless they agreed to remain on active duty a period of 2 years in an operational billet for each year of education. Since these are exceptional cases, retention rates for these sources are neither available nor pertinent to this statement.

(*c*) Generally speaking, educational opportunities are available only to those officers who have chosen the Navy as a career; normal eligibility for graduate education occurring after the third year of commissioned service.

Before embarking upon a graduate educational endeavor, officers must obligate themselves to serve 2 years for each year of education completed. Through this obligation, the Navy is assured a service return for its educational investment.

The average duration of the Navy's graduate scientific and engineering curriculums is 3 years, which carries a 6-year service obligation upon completion of instruction.

Therefore, retention rates of postgraduate career officers beyond their minimum service requirement which, based on the foregoing, is 12 years after commissioning, is exceptionally high.

The fact that better than 50 percent of last year's selections for flag rank were officers with technical postgraduate educational backgrounds is evidence of the high rate of retention of the highly educated naval officers, and the ever-increasing importance being given to advanced education.

2. Enlisted

Because of various reasons such as heavy operating schedules, long periods away from home, and because of excellent opportunities in civilian industry, the Navy has experienced difficulty in retaining outstanding enlisted personnel beyond their first enlistment.

For example, the table below shows the retention rate of certain highly technical ratings at the end of their first enlistment for fiscal years 1955, 1956, 1957, and the first half of 1958. The ratings involved are: Radarman, electronics technician, aviation electronics technician, communications technician, interior communications electrician, boilerman, sonarman, fire control technician, radioman.

First term reenlistments

Fiscal year	Number eligible	Number reenlisted	Percent
1955	24,891	1,313	5.3
1956	20,958	1,723	8.2
1957	12,854	1,388	9.3
1958	7,932	1,007	12.7

This large turnover of basically trained, high-potential, first-enlistment personnel is one of the Navy's greatest problems. The cost in time, money, men, facilities, and materials in constantly replacing and training these men imposes a heavy drain on Navy resources. The Navy is continually endeavoring to

solve this problem by such means as reenlistment bonuses, increased educational opportunities (NEASP, NESEP), career appraisal teams, increased emphasis on leadership, increased opportunities for advancement, more equitable sea/shore rotational policies, and choice of duty station at time of reenlistment. The recent Cordiner study is aimed at solution of this problem.

After the first reenlistment of a technician, experience has shown that the chances of retaining him for a career in the Navy is greatly increased. For example, the retention rate in the same ratings previously mentioned over a like period of time for personnel who have previously reenlisted (career personnel) is shown below:

Career personnel reenlistments

Fiscal year	Number eligible	Number reenlisted	Percent
1955	1,669	999	59.9
1956	5,341	4,992	93.5
1957	6,648	5,568	83.8
1958	2,383	2,036	85.4

E. EVALUATION

1. Current and foreseeable requirements

(*a*) I now come to the point of evaluating our position with respect to current and foreseeable requirements. I have previously outlined the steps we have taken and are taking to stretch our resources over the greatest possible area. We are, of course, not always able to stretch far enough to give us the potential we need for every occasion.

(*b*) Education and technical training are necessities for the Navy with its high degree of technological complexity. The extent of all the effort devoted to such education and training must be weighed against all other demands for personnel. In the present times of austere manpower ceilings, care must be taken that the personnel and funds that are used in educational efforts do not adversely affect the operating forces. In view of the current ceilings, the educational endeavor is highly desirable, but not feasible without an increase in overall Navy strength.

(*c*) We shall continue our efforts to adjust and revise our program to obtain maximum usefullness of the resources given to us. I will now touch on some of the adjustments we are currently making to give us greater potential in the scientific and engineering areas.

2. What is being done to adjust education and training programs to meet foreseen future needs?

(*a*) *Postgraduate education.*—The scientific and engineering curriculums of the Navy's postgraduate educational program are under continuous review to insure that the Navy's trained officer manpower may be abreast of and in some instances ahead of technological advances. Many of the Navy's present curriculums support various component knowledges included in the general concept of space technology, which makes it feasible for the Navy to embark without delay on the new frontier of outer space.

As mentioned earlier, an increase in naval officer postgraduate education is being effected. Commencing with academic year 1957, a buildup of input was started which will total approximately 100 percent when fully phased in over a 5-year period.

(*b*) *Undergraduate education.*—Additional emphasis has been given to scientific and engineering areas in the NROTC and other Navy-sponsored undergraduate educational programs. More rigid requirements for mathematical and scientific projects are being placed on students in these programs. Three important steps have recently been taken in officer-candidate-training programs.

a. Effective with the next entering class of Regular NROTC students, additional limitations have been placed upon the academic majors which such students may follow. This will result in an even greater number taking work in scientific and engineering fields.

b. The mathematics requirements of Regular NROTC students has been increased.

(*c*). Graduates of the Reserve officer candidate and contract NROTC program (Reserve officers) will be permitted a delay in call to active duty sufficient to enable them to obtain a master's degree if such graduate work is in the field of engineering, mathematics, physics, or chemistry.

(*c*) *Enlisted technical.*—The increasing number and complexity of equipments and systems of equipments has aggravated the shortage of personnel mentally qualified to learn the operation and maintenance of these equipments and equipment systems. It is mandatory that maximum possible utilization be made of the limited pool of high mental-level personnel. Further, the fact that 80 percent or more of the personnel who must do the job are not career personnel (they leave the Navy after their first enlistment) has to be considered in the planning full use of potential.

For the past several years the Chief of Naval Personnel has been adjusting training programs to meet this new situation. Courses have been reviewed repeatedly to eliminate all but the essentials—to limit training time and to make a new recruit into a useful apprentice technician in the shortest possible time. To further this aim, a greater degree of specialization has been introduced at the lower petty officer levels. Ratings and courses which once attempted to cover a number of technical areas have been divided into several segments or packages which produce specialists qualified to perform operator and/or maintenance duties in an extremely limited area—for example, a single fire control or missile launcher system.

This concept, first adopted in the areas of electronic technicians and fire-control technicians, is being rapidly applied to the entire rating structure of the Navy. The packaged training reduces by many weeks the training time required to prepare a useful apprentice; conversely, each of these noncareer men spends many more weeks of his enlistment as a useful member of the operating team. Broader qualifications in a rating are attained in second and subsequent enlistments through additional courses and in-service training for the higher petty officer rates.

The package training concept outlined above, together with other programs such as the Navy enlisted advanced school program and the Navy enlisted scientific education program, which I have previously mentioned, is being utilized in planning training for the new Navy in the atomic missile and space age to utilize the potential of noncareer and career personnel to the fullest possible degree.

3. Limitations involved

(*a*) It is considered that the Navy educational and training program in the sciences and engineering is based soundly on demonstrated requirements. Its full implementation is, however, at times handicapped by shortages of qualified and available personnel, by lack of funds for professors, materials and physical facilities and by shortage of training time (allocation of student billets).

In these factors, the education program continually competes with operational requirements for a proper share of the Navy's decreasing personnel ceiling.

This often places the education program, which is a longer-range need, at a disadvantage in relation to immediate operational needs of the forces afloat. Consequently, it is not always possible to obtain sufficient qualified personnel, who can be spared from other essential duties to enroll in the educational and training program. Likewise, funds and trainee billets are often in too-short supply, because of pressures from other essential areas, to meet fully the requirements for the education and training of officers and enlisted personnel.

(*b*) We can materially improve this situation by finding means of increasing our retention rates of trained and educated personnel, particularly in the enlisted category. I have previously noted that we are improving in this respect. We still have a long way to go. This, of course, is an area that demands and receives our constant attention.

We are continually striving to find the means of persuading our quality and qualified personnel to become career Navy personnel. Many of the factors involved are, of course, beyond our control. For example, the granting of increased pay for military personnel by this session of the Congress would, we think, give us increased competitive potential which would help to retain our educated and trained quality personnel.

F. CONCLUSIONS

The success of the Navy's program of education and training in the scientific, technical, and engineering fields is dependent upon the availability of sound and imaginative leadership, excellent planning, qualified personnel, adequate funds including those required for equipment and physical facilities, and the

availability of sufficient training time to permit officers and men to engage in educational pursuits.

Outstanding judgment must be exercised in resolving the continuous conflicts that exist between requirements and the ability to meet them. This condition becomes increasingly serious at this time when greater emphasis on scientific and engineering fields demands an allocation of additional numbers of billets to education and training programs.

In summary, the Navy feels that all things considered, our ability to cope with the scientific age is equal to our ability to cope with other serious problems faced in these days of international tensions, extended operational commitments, and austere personnel and funding ceilings. We are constantly endeavoring to increase our efficiency and combat readiness. We feel we have the means and the methods by which, given proper funds and personnel, the United States Navy will continue to be the world's most potent force afloat and an important deterrent to all-out war as well as cold war limited aggression.

Mr. COURTNEY. General Berkeley is here from the Marine Corps. General, you have a prepared statement?

STATEMENT OF BRIG. GEN. JAMES F. BERKELEY, UNITED STATES MARINE CORPS

General BERKELEY. Mr. Chairman, the Marine Corps is primarily a tactical force in readiness. We are not required to engage in basic research; therefore, we have no current requirement for scientists, per se. However, we do have a requirement for scientifically trained personnel in both the officer and enlisted fields.

Our requirements can be broken down into two general areas: those required to support applied research and procurement activities, and those required to establish and maintain maximum combat capabilities with new equipment and weapons as they are delivered.

Generally speaking, the requirements in the first area demand that certain officer personnel be trained engineers and technologists. The basic education required can only be procured in our civilian educational institutions or at the Navy postgraduate school.

The Marine Corps must share with the other services and industry the available scientific graduates of our colleges. While we have no special program designed solely to recruit these graduates, we welcome and try to obtain those that will choose the Marine Corps for a career.

However, since the number is limited and we particularly need career personnel, we are forced to look to our own ranks for development of some of the talent required. In effect, we primarily grow our own.

First, we offer selected officers an opportunity to attend civilian institutions for postgraduate work. The fields involved are engineering, ordnance, aerology, and nuclear effects. This program is tailored to meet our specific needs. This year we are sending 26 officers to advanced engineering courses.

Generally, officers of the grades of captain and major are selected. This insures that the officers trained have been evaluated and we have a better chance of obtaining career-motivated personnel.

Since we are using the Navy postgraduate school at Monterey for much of our training, the total tuition cost to the Marine Corps is approximately $22,500 a year.

With the increased demand for highly trained men in industry and in the other services, we anticipate that our increasing require-

ments for such officers will be difficult to meet by using postgraduate training alone.

Therefore, we have recently entered into a program for the advanced education of enlisted personnel in technical fields. In conjunction with the Navy, we will send up to 50 selected marines per year to civilian universities to take 4- to 5-year courses in engineering and other fields.

Upon graduation these individuals are eligible for commission in the Marine Corps and will be considered for this status. They will then be required to serve at least 1 year for every year of schooling they have received from the Government.

This program will provide qualified technical officers, who, we expect, will be disposed toward a career in the service.

This program has generated wide interest among those marines eligible. Therefore, we expect that this source will enable us to readily expand our program to meet any future demands.

With the matter of establishing and maintaining maximum combat efficiency, our problem is in both the officer and the enlisted fields. We have a shortage which can be expressed in terms of numbers, but is most acute in terms of experience level, particularly of our enlisted technicians. The complexities of modern training require enlisted radar technicians, aerologists, electronic technicians, and electronic data processing personnel to be technologists in every sense of the word.

Generally, the training in these fields must be accomplished within the military services. While certain industrial facilities are employed to assist in this training, we find that our training facilites are, to some extent, supplying these technologists to industry.

Our problem is primarily one of retention after we have trained our personnel. The Department of Defense has requested Congress to revise the current pay structure to provide added incentives to these men to stay in the service. We consider that these new pay provisions will provide a tool that will assist us in improving retention of these technicians.

We select enlisted men for technical schooling and for the advanced education program from among personnel on active duty in the Marine Corps.

As of yesterday, we had received some 2,600 applications to fill 20 openings.

In order to improve our selection base, we are constantly striving to improve the quality of our recruits. Recently, the Department of Defense has reduced the percentage of lower mental group recruits who must be accepted by each service. As far as the Marine Corps is concerned, this is another step that will assist us in meeting our technician requirements.

Since the Marine Corps is primarily a tactical organization, we have no requirement at present for civilian trained scientists and engineers in our enlisted fields. In those cases where such training is given to enlisted personnel at civilian educational institutions, the personnel involved are working toward a commission as well as toward their speciality in the scientific field.

In summary, our scientific training program in civilian institutions is modest. In terms of dollars, it is small; however, this money is spent most selectively. In order to protect the best interests of the Government, we make every effort to insure that the personnel trained

are motivated toward a career. In anticipation of our increased requirements, we are training selected enlisted men in civilian educational institutions for service as officers with engineer and scientific experience. We believe that if the pay revisions requested are provided, we will be able to retain the enlisted technicians that are essential in this era of scientific defense.

Our program is under continual review. It is based on demonstrated need. While we consider that it is sufficient to meet our present and anticipated requirements, we are prepared to expand as the situation demands.

Mr. HESS. You don't have the civil service problem, though, that the Navy has.

General BERKELEY. Our civil service problem works under the Navy industrial relations officer. I as the manpower coordinator in the Marine Corps deal through Admiral Cronin's office in the civil service area. He covered all our problems. We have none of the pure scientific problems the admiral spoke of.

Mr. HESS. How does your retention of the graduates of the Holloway plan compare with Admiral Dornin's statement about the Navy?

General BERKELEY. We are very fortunate, sir. Admiral Smith told me last week our retention rate is a little over 40 percent, of the Holloway plan people.

Mr. HESS. Twice as much as the Navy.

How about the submarine officers?

Admiral DORNIN. It is improving this year. Probably the overall percentage will go up to 25.

Mr. COURTNEY. Mr. Hess wanted to know about the submarine officers.

Mr. HESS. How about the submarine officers. You say for the aviator your retention rate is greater.

Admiral DORNIN. Of course, they are not selected for submarine when they graduate from the school and come into the Navy. They have to wait and be selected. Once they get into the submarine—if they are accepted, I would guess it is very high, for obvious reasons.

Mr. HÉBERT. Admiral Cronin, in connection with your industrial problem of your scientists and your engineers, I am to understand, of course, we are talking strictly civilians. That has been established.

Admiral CRONIN. Yes, sir.

Mr. HÉBERT. Now these civilians are employed in naval yards and naval installations and ordnance plants?

Admiral CRONIN. That is correct.

Mr. HÉBERT. Strictly within the Navy area.

Admiral CRONIN. That is correct, yes, sir.

Mr. HÉBERT. Not in any construction area?

Admiral CRONIN. Not in private industry, no. Not working for the Navy under private contract.

Mr. HÉBERT. For instance, the Navy yard down at Norfolk?

Admiral CRONIN. Yes, sir. I am talking about those.

Mr. HÉBERT. You have Navy yards and Navy construction in that area?

Admiral CRONIN. Yes, sir. Naval shipyards and laboratories in the main.

Mr. COURTNEY. Of this category, there is roughly 18,000?

Admiral CRONIN. Yes, sir, that is correct.

Mr. HÉBERT. Well, thank you gentlemen very much. We appreciate your appearance. And I will say it is very heartening to hear the testimony, at least two-thirds of it. The other third is a problem, which is not your making, Admiral. We hope we may be able to do something to correct that.

The committee stands recessed until Tuesday at 2 o'clock.

Mr. COURTNEY. That will be the Department of the Army.

(Whereupon, at 3:30 p. m., the subcommittee adjourned to reconvene at 2 p. m., Tuesday, March 18, 1958.)

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SPECIAL SUBCOMMITTEE No. 6,
Washington, D. C., March 18, 1958.

The subcommittee met at 2 p. m., Hon. F. Edward Hébert (chairman of the subcommittee) presiding, with Mr. Hardy, Mr. Kitchin, and Mr. Hess.

Mr. HÉBERT. The committee will be in order.

Mr. COURTNEY. We have, Mr. Chairman, Gen. Theodore Conway and representatives of the Army on the second phase of the inquiry directed by the full committee dealing with difficulties with respect to scientists and engineers in the armed services.

The first witness is General Conway, who is here, he to be followed by Mr. Willey, General Rich, General Beach, and General Hinrichs, in that order.

Mr. HÉBERT. None of you gentlemen have been sworn and you did not appear before the full committee.

Mr. COURTNEY. General Beach has been sworn.

Mr. HÉBERT. Now, the gentlemen who have not been sworn, please rise.

Do you, and each of you, solemnly swear that the testimony you will give before this subcommittee in the matters now under consideration will be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. WILLEY. I do.

General CONWAY. I do.

General RICH. I do.

General HINRICHS. I do.

Mr. COURTNEY. General, you have a prepared statement.

STATEMENT OF BRIG. GEN. THEODORE J. CONWAY, DIRECTOR OF RESEARCH, OFFICE OF THE CHIEF OF RESEARCH AND DEVELOPMENT OF THE ARMY

General CONWAY. Yes, sir.

Mr. Chairman, and gentlemen, I am Brig. Gen. Theodore J. Conway, Director of Research in the Office of the Chief of Research and Development of the Army. In this capacity, I am the principal subordinate of the Chief of Research and Development for the research portion of the Army research and development program. I will discuss, responsive to your request, methods of encouraging greater advances in scientific knowledge insofar as they relate to defense matters.

I have submitted a prepared statement, and I propose to follow the general outline of the statement, discussing, if there is no objection, certain aspects raised in the prepared matter.

Mr. HÉBERT. You present it as you desire, General.

General CONWAY. Yes, sir.

In order to encourage greater advances in scientific fields, the Army—

1. Suports a basic research program.
2. Fosters the exchange of scientific information.

At this time, our basic research program amounts to approximately $20 million annually. This is of the order of 5 percent of our research and development budget. Our program can be divided roughly into four broad areas; namely, physical, mathematical and engineering sciences; geophysical sciences; biological and medical sciences; and operations and human factors research.

The bulk of the fundamental research in the physical, mathematical, and engineering sciences is administered by the Office of Ordnance Research at Durham, N. C. This Office contracts annually for about $4½ million worth of research. Practically all of this effort is conducted at universities and nonprofit research establishments.

Research proposals supported through this program are usually related to areas of interest to Army Ordnance, but because of their fundamental nature many have wide scientific application. Also, in the physical and engineering sciences, but more closely linked with developmental requirements is the general research program of the Army Signal Corps funded at an annual level of approximately $3 million. The majority of this money supports work sponsored jointly by the Army, Navy, and Air Force at the Massachusetts Institute of Technology, Stanford University, Harvard University, Columbia University, and the Brooklyn Polytechnical Institute.

In the same fields of physical and engineering science with some additional effort in biology the Army Quartermaster conducts investigations designed to improve the efficiency of the individual soldier under all types of environmental conditions.

Examples:

1. Army Mathematics Research Center.
2. Free radical program.
3. Tubes and components: MASER—high-power transmitting tubes for radar-solar cells.

The bulk of our fundamental research in geophysical sciences is supported by the Army engineers and the Army Signal Corps. We are concerned with geography, cartography, meteorology, geodesy, and earth physics.

Examples:

1. Greenland.
2. Fort Churchill IGY.
3. Land lomocotion: Vicksburg Waterways Experiment Center.

In the biological and medical sciences, the Army Chemical Corps and the Army Medical Service support designed to produce greater knowledge of the effects, control and treatment of many varied diseases.

Examples:

1. Asian flu vaccine.
2. Burn treatment by surgery and enzymatic debridement.

By supporting operations and human-factors research, we seek to apply the most modern scientific techniques to the solution of operational problems, as well as to those relating to training and leadership.

Example:

Train fire.

Electronics training course, Fort Bliss.

You may have noticed in the Washington paper this weekend that we have just established an Army research office.

Our purpose is to provide a contact between the civilian scientific community and the Army as well as to improve the coordination of our program within the Army. Here we hope to build a scientific staff to analyze and project the Army research program and to integrate the total scientific effort of the Army technical services.

The spectrum of effort which includes research at one extreme and production of developmental models at the other, includes many varieties of applied research and engineering. In most of our laboratories and arsenals basic research scientists work alongside of other scientists and engineers seeking to translate abstract concepts into new components and equipment. In such an effort the exchange of scientific information becomes very important.

Many different channels exist which facilitate the exchange of scientific information. No one channel is all-important. The most significant of these channels are: Journals sponsored by scientific associations; formal publications of many lesser types; research program summary documents: person-to-person visits of scientific personnel; scientific symposiums, conferences and meetings; and scientific advisory committee reviews of portions of the Army research and development program. Army policy encourages and supports the free exchange of scientific information utilizing all of these channels.

In an effort to further encourage the exchange of scientific information, we held the first armywide science conference at the United States Military Academy at West Point in June of 1957.

The conference was attended by over 400 military and civilian scientists and engineers of the Department of the Army, with guests from the other military departments.

One hundred and one technical papers were presented, including fifty-eight classified papers. This conference provided due recognition for Army scientists working with classified projects and effected a broad exchange of the results of research. Copies of the papers presented at the conference have been widely distributed, and are available through the Armed Services Technical Information Agency.

Approximately twice each year, we sponsor a meeting of our key civilian scientists. These meetings were initiated in 1956 based on recommendations of the Army scientific advisory panel. They have been held every 6 months since that time at major research and development or training installations to make the key civilian scientists of our technical services broadly aware of important military technical requirements. The next conference is scheduled for May 1 at Fort Huachuca, the Army electronic proving ground.

Examples:

1. Chief scientists' council.
2. Annual research task summary.
3. Army research and development review board.

In summary, gentlemen, I have outlined the following methods whereby we encourage greater advances in scientic knowledge insofar as they relate to defense matters.

1. We support a basic research program that covers four broad areas; namely, physical, mathematical, and engineering sciences; geophysical sciences, biological and medical sciences and operations and human factors research.

2. We foster the exchange of scientific information by publishing results in many different types of scientific journals, through armywide science conferences and through meetings of our key civilian scientists.

In placing emphasis that I have on the scientific aspects of research, I do not mean to neglect the personnel factors which are all important. We consider that our scientists and engineers, both military and civilian, constitute the key element of our scientific program.

Consequently, management of this resource is one of our principal concerns. Mr. Robert H. Willey, Director of Civilian Personnel, Department of the Army, will follow me, and will discuss in detail civilian personnel aspects of our scientific programs.

I have with me today Dr. Richard A. Weiss, the Acting Chief Scientist of the Army, and Dr. Roy B. Power, Chief Scientist for Army Ordnance. We will be happy to answer any questions you may have.

Mr. HÉBERT. Thank you very much, General.

Mr. COURTNEY. Mr. Chairman, Mr. Willey has a prepared statement, to follow the general's presentation.

Mr. Willey, will you proceed in your own way, please?

STATEMENT OF MR. ROBERT H. WILLEY, DIRECTOR OF CIVILIAN PERSONNEL, DEPARTMENT OF THE ARMY

Mr. WILLEY. Yes, Mr. Chairman.

As already identified, I am Director of Civilian Personnel for the Army. I have the prepared statement which Mr. Courtney has given to you. In view of the number of witnesses that you have, and the time that is involved, I would like to suggest that I can give you a brief recap of the statement, that might highlight it.

Mr. HÉBERT. However, at this point, we shall include your statement as having been read into the record.

(The statement is as follows:)

Mr. WILLEY. Mr. Chairman and members of the committee, I am Robert H. Willey, Director of Civilian Personnel for the Department of the Army. I have a short prepared statement designed to give you a summary picture of our current situation with regard to the procurement, development, and utilization of civilian scientists and engineers. I would like to present that statement, after which I will be available for further discussion of any additional points which you may desire to examine.

We are fully aware that our ability to recruit and retain scientific and technical talent of the highest caliber bears directly on the future position of this Nation from the standpoint of military technology. This is by no means a recent discovery on our part. Great emphasis has been placed on the recruitment, retention, and utilization of scarce scientific talent for more than a decade. For example, in 1947, our Department was primarily responsible for the first successful recom-

mendation to Congress that our top scientists be given special pay recognition. At about the same time, we initiated pioneer research and experimentation in improved utilization of engineers and scientists through eliminating routine or nontechnical work from their tasks.

This culminated in the publication in 1953 of a very popular handbook on job engineering techniques and has been given increased emphasis recently under the "Man Friday" and similar programs for relieving scientists and engineers from routine procedural work.

Most significantly, we undertook almost 2 years ago a completely thorough and comprehensive factfinding survey to determine precisely the posture of our civilian scientific manpower program and the steps needed to correct its deficiencies.

The data collected during that survey and the conclusions drawn therefrom are now more than a year old. However, we believe that they remain essentially valid. They provided us with specific targets toward which our programs should be aimed, as contrasted with generalizations and assumptions on which we would otherwise have to rely.

One of the significant revelations of this survey came as a welcome surprise. We find that, despite all general assumptions and claims to the contrary, our turnover rate for engineers and scientists in the research and development field is lower than that which prevails for the Department's work force as a whole. The annual quit rate for engineers and scientists was 9.9 percent as compared with 11.3 percent for Army employees as a whole during the same period.

By the same token, we secured specific factual support for earlier assumptions, that inadequate pay treatment or lack of advancement opportunity constitute the dominant factors that influence turnover.

Of 449 former employees who answered our questionnaire, 63 percent had received salary increases; 84 percent of those who went to private industry had received more favorable salaries. Nearly 200 of this sample had received salaries with Army at or above $6,400, and of this group 61 percent received raises of $1,000 or more per year. Offsetting this to some extent is the fact that of the employees surveyed, 29 percent had received offers from other Government agencies and 40 percent from private industry during the preceding year, but had refused such offers and remained with the Army.

You will be interested to know that the information contained in this survey report has been utilized to the fullest possible extent. It was drawn upon heavily to furnish data to the Cordiner Committee, the White House group working on professional personnel problems, the Davis subcommittee, and other groups. It has been presented to and discussed with all responsible elements of the Army staff and secretariat and has provided the primary basis for a year's concentrated work on overhauling those policies and programs of the Department where deficiencies were indicated. General Gavin personally transmitted a summary of its findings and recommendations to the commanders of all research and development activities with the result that full command attention and support has been given to the matter.

Before discussing some of the specific things being prosecuted now to improve our capabilities to attract and retain competent professional technicians, I should like to summarize our present situation. The general shortage of this type of manpower is well known and we continue to experience difficulty in the recruitment and retention of a work force to meet our indicated needs.

I do not mean to be an alarmist on the point, nor is there any basis for hysteria about our situation. Numerically, the number of critical vacancies is not large, slightly over 600 were reported as of the end of 1957, against a total estimated work force of 11,000 research and development scientists and engineers. There are also some indications that the recruitment problem has eased slightly over the past few months.

Despite these optimistic factors, the backlog of unfilled positions constitutes a continuing problem. In the present market, the recruitment of 600 engineers and scientists represents a gigantic task, regardless of its comparison with the total work force—especially when normal turnover keeps adding to the job. Our task is made much more difficult by the fact that our competitive position is poor as to salaries, advancement opportunity, and other benefits in trying to secure top-flight people who are also being sought by private industry.

You appreciate, I am sure, that these pay factors are beyond the Department's capacity to alter. I should like to indicate, however, several of the areas where legislative relief would be helpful.

First, existing limitations on the number of top-level positions makes it impossible to give adequate salary recognition to the people now carrying heavy responsibilities.

In addition, this situation severely restricts advancement possibilities for their subordinates and creates a compression on proper grade alinement below the top technical jobs. Today, we have authority to employ only 36 scientists in so-called Public Law 313 jobs; a recent reexamination of our needs revealed that 174 positions in this category are fully justified by existing requirements, in addition to a large number of positions needed to meet our requirements for high-level managerial talent.

At the other end of the scale, salary problems are also believed responsible for difficulties in recruiting at the entry level.

During the 1956–57 academic year, the 4 technical services which utilized the bulk of our technical manpower were able to secure only 32 percent of their carefully calculated needs for college graduates. Recent action by the Civil Service Commission in authorizing recruitment at rates above the normal entry level, coupled with current economic conditions, will undoubtedly improve the situation this semester, but it appears certain that competition will continue strong for the best qualified graduates needed for research and development activities.

In between the extremes noted above, we are confronted with equally serious problems at intervening levels of responsibility. The Cordiner Committee report concludes that Government rates ranged 15 to 20 percent below comparable jobs in industry, being $400 to $800 low at the entrance level and $3,000 low at the top of the regular Government scale.

One other direct monetary factor needs to be cited: the direct costs of recruiting a qualified person and putting him on the job. This is a cost assumed by most private employers in any scarce skill category.

Yet, except for overseas jobs or Government personnel transferring from one activity to another, we are not authorized to pay travel and moving expenses or the other costs that a man incurs in taking a new job at another location.

As you know, all of these items are incorporated in legislative proposals currently pending before the Congress.

Confronted with the problems I have outlined, the Department has been compelled to place its program emphasis on and to exploit those areas where existing law and budget resources provided an adequate base. I wish to summarize some of the significant actions which the Department has taken within its own authority to enhance the recruitment, development, use and retention of these professional scarce skills.

Army utilizes several programs to provide a systematic, planned input of new professional talent each year. These include specifically tailored programs (involving 1,900 persons during 1957) of summer employment for college students, who then become a prime source of full-time employment after graduation.

Within the Corps of Engineers, a special junior engineer program of rotational training assignments has been widely used to recruit, develop, and retain new graduates. In addition, a new program of coordinate college recruitment was successfully launched during 1957 which promises even more effective results in attracting new professional level scientists and engineers from the campuses to the Army.

One of the most successful plans which has been used involved cooperative training agreements with colleges. These permit undergraduate scientific and engineering students to work with the Army during a part of the year while attending college at their own expense during other periods.

Over 800 students from 60 colleges are currently working at 30 research and development activities of the Army under cooperative training agreements. Upon graduation, these students, because of their Army training and experience, are exceptionally well qualified for positions at the professional level. Moreover, during the period of their college work, the Department has secured their services at an increasingly professional level, thereby supplementing its technical work force.

In addition to continuing the development of highly qualified personnel who are being recruited under the above programs, the Army makes full use of current authority to provide outside training. Specialized training of technical and engineering personnel is being provided by contracts with educational institutions and industrial organizations. During fiscal year 1957, a total of 5,266 civilian employees received training under contract at a cost of $558,578. Included in those totals are the costs of training 3,680 employees in scientific and engineering subjects.

Public recognition of the accomplishments of Army engineers and scientists also has been a matter of special action by the Department. A step taken for the first time this year has been the adaptation of the incentive awards program to the special requirement of engineering and scientific personnel. A special group of awards has been developed for authors of outstanding scientific papers. These awards were presented at the first Department of the Army conference held at West Point, June 25–28, 1957. Ten papers were selected from 96 to read at the conference by a panel of senior scientists representing the major fields of scientific endeavor in the United States, as particularly significant contributions to Army science.

The authors were awarded special citations and honorariums from $300 to $750. Authors of 11 additional papers received special citations.

Special awards have also been developed for employee inventors. While procedures have long existed to secure patents for employee inventions, the purpose of the new awards is to stimulate the disclosure of patentable ideas by Army personnel for patenting through the Department of Army facilities.

The achievements of individuals and groups are also being publicized through such mediums as competitions; "name awards" issued as memorials to past Army personnel of great scientific stature; and vigorous sponsorship of Army personnel as candidates for awards and recognition external to the Army.

This marks the first full year of operation of the Secretary of the Army research and study fellowship program. In line with a policy statement of the President and the Hoover Commission's recommendations for the improvement of civilian executive and professional personnel in Government on August 28, 1956, the Secretary of the Army announced a program for research and study fellowships. This is a significant career-incentive program, particularly suited to participation by scientific and engineering personnel.

It emphasizes the recognition, development, and increased use of creative talents of Army civilians. Fellowship winners spend from 6 to 12 months conducting study of research on problems in their special fields which will benefit the Army. Of the 27 awards granted to date, 20—74 percent—have been made to professional scientists, engineers, or, in 3 cases, executives whose projects are directly related to scientific research or engineering.

I have already mentioned our long-standing efforts to secure better utilization of scientific skills. This was given added emphasis when, during our survey of research and development personnel problems, many scientists complained that administrative and other nontechnical work consumed as much as 30 percent of their time. The assignment of administrative aids and other lower skill level assistants has been encouraged under the code name Man Friday. This technique has been widely adopted and, coupled with special simplification of supply requisitioning procedures, has made available thousands of man-hours for technical work which might otherwise have been tied down by nonproductive administrative chores.

Efforts have been made to improve utilization of professional skills in other ways also. Skill utilization committees have been set up at most installations employing engineering and scientific personnel. These groups serve as watchdogs to assure that management surveys, job engineering studies, and other actions are properly directed toward total use of scarce skills. The required annual evaluation of positions has also been used as a systematic device for determining the proportion of time devoted to professional work. A skills-utilization index is then used to indicate which situations require corrective action.

The Civil Service Commission has recently authorized controlled use of paid advertising, a step which the Department has advocated for some time. This is too recent a development to support any conclusion as to its results; however, we are proceeding rapidly with plans for its full use in all appropriate cases.

As a matter of record, the voluntary word-of-mouth campaign by current employees, who have found challenging and worthwhile careers in the Army, has been very effective advertising. In addition,

wide use has been made of installation and command recruiting brochures.

Above all, the Department of the Army considers that the most effective program for achievement of maximum utilization, development on the job, and motivation of scientists and engineers, is one which provides for a career system on the widest possible organizational basis. Our career planning for occupations in the sciences and engineering has as its overall objective the improvement of our utilization development, and motivation of such key personnel.

In summary, therefore, we share the difficulties of all employers who must draw from skills which are in such short supply. Our shortage of scientific manpower is substantial, but by no means critical in terms of bulk requirements. We feel that we have done reasonably well with the tools now at hand.

Our scientists stay with us despite pay disparities and offers from the outside with the result that turnover in this group is lower than in the work force as a whole. Through the devices outlined, we feel that Army is regarded as a good place to work since our most effective source of recruitment is the existing work force.

Nearly one-third of our scientists and engineers have come to us through personal contact with an individual already working for the Army. These factors afford no basis for complacency. Many of our program efforts are in the stage of infancy and we are fully aware that we have probably only just entered the contest for world scientific supremacy. Whatever may have been our successes or deficiencies in the past, you may be assured that a major part of the Department's personnel management emphasis for the indefinite future must and will be concentrated in this area.

Mr. Chairman, this concludes the remarks I had prepared to indicate our present situation. I am now at your disposal for the purpose of discussing any points in which you have a particular interest.

Mr. HÉBERT. Now you may comment.

Mr. WILLEY. All right, sir.

As General Conway has just indicated, the Army has long been well aware of the necessity for getting, using fully and keeping its top-level scientists and engineers. It has continually watched the personnel management of this group and we think has initiated a number of substantial improvements.

I would like to point out specifically that the pay system which enables us to get some of our people at above Classification Act rates under the terms of Public Law 313 was a proposal that the Army sponsored a long time ago.

Also, it has undertaken a very significant series of studies into job engineering and has a well-devised technique and plan for this activity. This material has been published and is now used rather extensively to eliminate lower grade or administrative duties. This is known as Man Friday, which you perhaps have heard about.

Another development that we think is significant is that less than 2 years ago, during 1956, a specialized survey of personnel management affecting 4,000 of our current scientists and 500 of our former scientists and engineers was undertaken as a very specific type of research.

The idea was to take a look at the kind of personnel management our people were getting and the kind of personnel management that the

people were getting who have left us, to see what possible improvements we could put into the system we now have.

Now, this study has been used very extensively. It was used as a backup for other studies that were made within the Government. And it afforded the Army an opportunity to see the things that we had been feeling and knowing a little bit about, but on which we didn't have specific factual data.

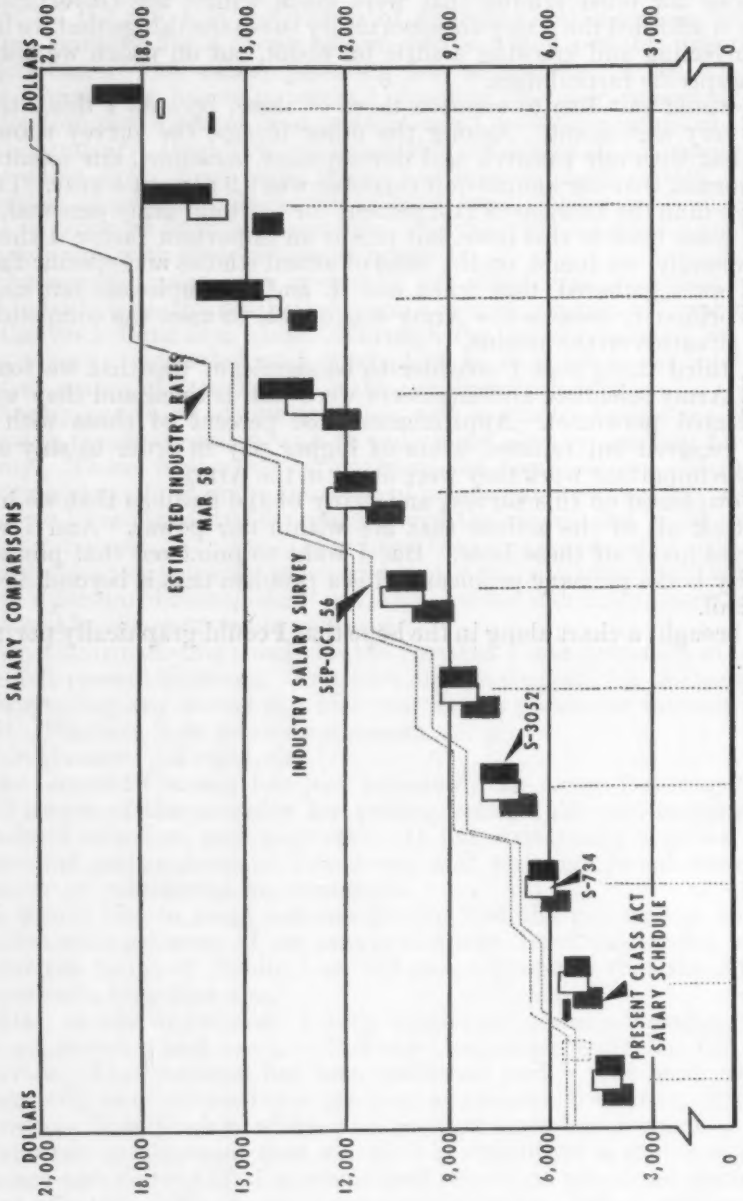
I would just like to mention three of these, because I think they are very significant. Among the other things, the survey showed us that with our research and development personnel, our scientific personnel, that our annual quit turnover was 9.9 percent a year. That is less than the average of 11.3 percent for our total army personal. I will come back to this later, but this is an important factor, I think.

Secondly, we found, on the basis of actual studies and specific facts that were gathered, that when our R. and D. employees left us, it was primarily because the Army was unable to meet the competitive pay situation on the outside.

A third thing that I consider to be signficant was that we found that Army scientists and engineers were well trained and they were dedicated personnel. Approximately 30 percent of those with us had received but rejected offers of higher pay in order to stay and do the important work they were doing in the Army.

Now, based on this survey, and many of the findings that we had, we took all of the actions that are within our power. And I will discuss many of these later. But I want to point out that pay disparity is the primary problem and is a problem that is beyond Army control.

I brought a chart along in the hope that I could graphically portray this.


SALARY COMPARISONS
DOLLARS
21,000
18,000
15,000
12,000
9,000
6,000
3,000
0
ESTIMATED INDUSTRY RATES
MAR 58
INDUSTRY SALARY SURVEY
SEP-OCT 56
S-3052
S-734
PRESENT CLASS ACT
SALARY SCHEDULE
GS-5
GS-7
GS-9
GS-11
GS-12
GS-13
GS-14
GS-15
GS-16
GS-17
GS-18

The code, or legend to this chart, is that the dotted box on the left in every case represents the current pay schedules of the Federal Government. The white box above it represents the pay schedule introduced in one of the bills that is now pending before the Congress, having been introduced by Senator Johnston for relief of this situation. The black box on the extreme right represents another bill that was introduced by Senator Carlson, that is S. 3052, to relieve this pay disparity problem.

The 2 lines immediately above represent 2 things. The first line, the lower line, represents the situation a year ago when the studies were made in connection with the Cordiner report as to what the private industry paid for jobs at corresponding levels of difficulty. The upper line represents the way these industrial pay levels have increased in the past year. So it represents the current situation. This endeavors, then, to point out how the pay movement has been in the past year.

Mr. COURTNEY. You don't have the corresponding industry or private employment depicted on there, do you?

Mr. WILLEY. The lower line, Mr. Courtney, represents the data that was gathered at the time of the Cordiner study. The upper line represents the Cordiner data that has been adjusted in accordance with subsequent surveys, primarily by Los Alamos, and one of the management associations. We have updated the material that was developed at the time of this Federal governmentwide study.

I would like to point out, Mr. Chairman, that at the beginning levels, at the journeyman or full worker level, and at the very top, there is a disparity at the present time. And these are, of course, the things that make it difficult for us to either attract or to keep the people that are now working for the Army, as well as for the rest of the Federal Government.

I would like to point out in addition that we have a problem of having a low ceiling on the number of top-level jobs in the scientific and engineering field—this matter of Public Law 313.

Now, the salary situation with Public Law 313 is better than it is for any other element of the Federal Government, in this line of work. It has a range of $12,500 at the beginning, to $19,000 at the top. It is also possible to adjust the salary in accordance with the scientific stature of the individual. In other words, you can have pay adjusted more on an individual basis than is usually the case in the civil service.

Mr. COURTNEY. What is the total number of slots?

Mr. WILLEY. The Army has 36, Mr. Courtney, and our bona fide carefully calculated needs are 174. And this is an example of the inadequacy of this number.

Mr. HESS. There are only 140 for all of the services, I believe; is that correct?

Mr. WILLEY. That is the information.

Mr. HESS. And your need is how many, 117?

Mr. WILLEY. 174 for the Army, alone.

Mr. HESS. 174.

Mr. WILLEY. Yes, sir.

Mr. COURTNEY. That is $12,000, and above.

Mr. WILLEY. $12,500 up to $19,000, that range, and with the special provision of having some pay flexibility, too.

Mr. COURTNEY. Yes.

Mr. WILLEY. Another problem that I think it only fair to point out in this pay area is the fact that the Federal Government lacks the ability to pay for interview or to pay for travel to the first duty station—practices which are very common in industry which, of course, is our primary competitor.

Now, I cite these three problems—the pay disparity, the lack of adequate Public Law 313 positions, and the inability to pay travel expenses—as examples of the pay problems which can be relieved only through favorable congressional action of which we are hopeful——

Mr. COURTNEY. How about advertising and institutional——

Mr. WILLEY. Yes, sir; we now have the authority to do institutional advertising. It is something that we have long sought, and have recently received. It is too new for us to able to gage the effectiveness of it. And I would like to mention that we have been doing a very effective job of advertising through self-advertising, of word of mouth from employees that now work for the Army.

Mr. COURTNEY. Let me ask you also in that same connection in that field, are you subject to regulation by the Civil Service Commission, and if so, to what extent?

Mr. WILLEY. Mr. Courtney, we are subject to review of the actions that we have taken from a policy standpoint, to see if we have done this in an effective way. As you undoubtedly know, the Federal Government for a long time has received lots of free institutional advertising.

This is one of the reasons that the Commission wants to review our action afterward to see how effective the use of paid advertising is going to be.

But as for detailed review, we are not subject to it.

Mr. KITCHIN. Will any one of the pending bills that you have shown on the chart take into consideration pay for travel expenses?

Mr. WILLEY. No, Mr. Kitchin, they don't. However, there is another bill that I didn't cite here, H. R. 11133, which provides for that kind of compensation.

Mr. HARDY. Is this inability to pay for travel—is that a statutory prohibition?

Mr. WILLEY. Yes, sir. We have no authority at the present time to pay travel to first duty station.

Mr. HARDY. And it can't be accomplished through administrative action?

Mr. WILLEY. No, sir. I want to be careful how I say this, because if a person were, for example, hired and employed in the Norfolk Engineer District, for example, and later on the Chief of Engineers found that he had to use that man in Sacramento, he could transfer the man at Government expense from Norfolk to Sacramento. But to pick him up in Norfolk for the specific purpose of transferring him to Sacramento would be improper and therefore, we don't do it.

Mr. COURTNEY. You would have no lawful authority to do it?

Mr. WILLEY. No, sir; that is right.

Mr. HÉBERT. Continue.

Mr. WILLEY. The summary of our problems on pay I just outlined. Let me tell you, though, some of the things that Army has done,

acting within its own authority, to keep its situation in the best possible posture.

We have a number of programs that provide the Army with a systematic planned input of fresh young talent, college graduates in the scientific, and engineering field.

We have a number of summer work programs at our large R. and D. activities, particularly, and we employed some 1,900 college students last summer. When these students graduate from college, they are already oriented to the Army. They have an understanding of the kind of work. And they serve as a primary source of recruitment.

The Corps of Engineers has a junior engineering program, that amounted to about 200 people last year, where young engineers are brought in and then are given specifically planned rotational assignments that give them a good background of the entire corps' work and gives them rotational type duty which improves their development. Of course, it has the additional advantage of giving the individual a sense of being well integrated and given specific development after he has been recruited.

Mr. COURTNEY. Now, you mentioned 200—slots, I suppose, or billets, or whatever you want to call it. How many applicants did you have and from what source?

Mr. WILLEY. Mr. Courtney, I do not have that information, I am sorry to say. I don't know how many applicants. But this is a fine program and of course, the Corps of Engineers is——

Mr. COURTNEY. Well, let me ask you this: Was it within Army or was it from outside sources?

Mr. WILLEY. These people came primarily from the colleges and universities.

Mr. COURTNEY. From the colleges and universities.

Mr. WILLEY. Yes, sir.

Mr. HESS. They are not military, but these are civilian employees.

Mr. WILLEY. These are civilian employees.

Our cooperative education program is one of which we are very proud. We have over 800 students in this cooperative educational program that is being used by some 30 of our installations. They have contacts that are well worked out in advance for a combined work and study program, with some 60 universities. Now, of course, the plan of this is to have the students go to school approximately 6 months of the year. During that period, they are on their own. They are paying their own expenses, and they are getting their education along a prescribed line leading to a scientific or engineering degree primarily. The other 6 months, they are working for the Army as full-time employees and therefore have an income.

Mr. COURTNEY. What are the terms of the commitment between the Army and these individuals, in terms not only of what they study during the 6 months that they are in school but in terms of their future, when they will have finished their education?

Mr. WILLEY. These programs, Mr. Courtney, are worked out with the universities. This follows a plan that was pioneered about 50 years ago by the University of Cincinnati, for industry. They work out a program with the university whereby selected students of appropriately high caliber are worked into this study program. They

take a prescribed series of courses. They spend half of their time, approximately, with industry. And at the end of that time, the individual is a free agent. He has no——

Mr. COURTNEY. Let me understand this. It is a selected program.

Mr. WILLEY. Yes, sir.

Mr. COURTNEY. Then what happens at the end of the program when you will have completed or qualified for your science degree. Let's assume that is what happens. What is the relationship between that individual and the Department of the Army?

Mr. WILLEY. There is no obligation for that individual to go with the Department of the Army at that point, as is the case in the co-op plans with industry also. There is no obligation.

Mr. COURTNEY. He is not an indentured servant.

Mr. WILLEY. No, he is not. He has paid his own way. He has earned his own way while he is working for the Army. He has worked as a regular employee and has been producing.

Mr. COURTNEY. In terms of dollars, what is the grade of the individual in this program within Government service? You spoke of him being on a 6-months' tour.

Mr. WILLEY. Yes, sir.

He would start at grade 2, which would be $2,960 a year, when he is a freshman. He would then advance the next year to grade 3, grade 4, grade 5, and at the conclusion of his degree he would be able to come in at the entrance scientific, professional level, which is the top of grade 5; $4,480.

Mr. COURTNEY. And that is slightly under industry, isn't it, in dollars?

Mr. WILLEY. Yes, sir.

Mr. COURTNEY. Perhaps as much as a thousand dollars.

Mr. HEBERT. I want to refresh my memory of the Navy testimony there. My recollection was—Mr. Hess doesn't have the same recollection—that the Navy program was a contractual obligation. Do you recall that?

Mr. HESS. That was for military.

Mr. HEBERT. Just military. All right.

Mr. COURTNEY. This is for civilians. We are dealing solely with civilians here.

Mr. WILLEY. Yes, sir.

Mr. COURTNEY. Go ahead.

Mr. WILLEY. I think maybe the Navy ought to have an opportunity to comment on the difference.

Mr. COURTNEY. At the moment, you are dealing solely with the civilian side of Army employment, is that correct?

Mr. WILLEY. That is right. We are talking only about the civilian cooperative education program as operated for Army.

Mr. COURTNEY. One question. In terms—and this may be repetition—of numbers, how many are in this program; that is, how many slots do you have, how much can you support, and what is your experience in terms of applications.

Mr. WILLEY. I don't have the information in terms of the number of applications. We have had a steady increase in the numbers of people involved in this program. Today, there are more than 800 students involved in it, and we think, confidently, that it will increase. This is a program that we have found to be very effective.

Mr. COURTNEY. Of course, now in this case, you are limited somewhat by geography, meaning that the opportunity for employment must be somewhere in proximity to the place of study, isn't that right?

Mr. WILLEY. Yes, sir, there is a relationship, although sometimes, as indicated here, we have 30 installations and 60 universities. An installation draws from more than one university, for example.

Mr. KITCHIN. May I ask a question there.

Mr. HÉBERT. Certainly.

Mr. KITCHIN. On this general line. I have heard through generalities from elements of industry that over the past 5 or 6 years, during industry's anxiety or apparent anxiety at the lack of scientists and engineers, that the colleges have experienced a general letdown in the caliber or quality of the engineer produced by the various universities, due to the fact, principally, I have been told, that these young students get a commitment in probably their sophomore or junior year, and knowing they have a job when they get out then they just coast from there on out. Has there been any experience in the Army that would indicate the fruitfulness or the lack of it, in that statement?

Mr. WILLEY. Mr. Kitchin, I could only answer that in this way. In this research and development survey that I alluded to earlier, one of the things we looked at very realistically was to see whether or not we were attracting the same quality of people as we were losing. We wanted to look honestly to see whether or not the best were leaving us and something lesser coming to us.

This was not true, according to every evidence that we were able to gather. On the basis of talking with supervisors, with colleges, and with other sources, we felt that our quality was staying up.

Now, I don't want to mislead you. The competition is terribly fierce.

Mr. COURTNEY. You mean competition with industry?

Mr. WILLEY. Our competition with industry, and the competition between elements of industry are also pretty fierce. There is always going to be, I feel, a tough job to attract our proportion of those high-caliber students.

Mr. KITCHIN. Well, my principal concern was that in this so-called anxiety status in which industry and all of us find ourselves at the present time, if we are not actually graduating a lot of mechanics that should be and could be, if they were put on their own initiative and had to seek a job after they got out of school—might become good engineers and scientists.

Mr. WILLEY. I don't think that I am in a position to know the quality of their training, other than what the supervisors of them have said, and their indication was that we are getting high-quality people. Army has done real well, I think, on this. Eighty-six percent of our scientific and engineering personnel are college graduates, and we have a good, high proportion, I think.

One other thing that we have done in an effort to make sure we are getting the very best possible kind of system. We have undertaken a coordinated college recruitment program in order to insure that we will have the best possible relationships and the best possible recruiting opportunities at the campus. Instead of having several Army installations visit a campus, one Army representative will visit the campus and will be the primary liaison and will build relation-

ships that we think would be most effective. This is a trick we have learned from others, and we expect it to have great promise in the future.

In addition to having a systematic input, Army believes that people who are still with the Army and that are part of its regular work force should be given systematic training. And some 3,626 scientists and engineers were given training at universities and other educational institutions during the past year. This is to keep their skills up, to advance their work capacity, to keep them abreast of the latest developments, in their disciplines and the profession.

General Conway did such a fine job about talking about the public recognition that I could almost omit reference to that. But one of the things that we have found out also is that scientists and engineers particularly prize recognition by their peers in the professions. A physicist wants to be recognized by other physicists. A chemist wants to be recognized by other chemists.

So we have adapted our awards and incentive programs in such a way as to make them more responsive to this very basic want of scientists and engineers. We have patterned a special awards program.

Mr. KITCHIN. I have two questions right there.

I don't want to break your chain of thought. One is: on this business of awards, recognition of scholarly attainments in the court of Government service, are you talking now about awards in dollars—these bonuses that are given out under the terms—I forgot what public law it is, but anyway——

Mr. WILLEY. Yes, sir, that is one type.

Mr. KITCHIN. That is one type.

Mr. WILLEY. Right, sir.

Mr. KITCHIN. What about the matter of—this you may not be able to answer, but if you can, I would appreciate it. What about the Bureau of Internal Revenue's view of advancements made by the Department of Army for schooling of these employees, either in the intermediate or in the postgraduate courses?

Mr. WILLEY. Mr. Courtney, I can't answer the latter part of it. I don't know of any problem with the Internal Revenue.

Mr. KITCHIN. Well, it isn't a question of problem. It is a question of taxes.

Mr. WILLEY. Well, what I mean is that I have never heard of any consideration that this wasn't something that was justified——

Mr. KITCHEN. The query—is it considered income or is it considered, as far as you know in the Department of the Army—is it considered income or is it merely a recognition of developmental needs within the Department of Army for which the Army is a beneficiary rather than the individual?

Well, if you don't know the answer, don't attempt it.

Mr. WILLEY. I would want to answer it this way. I would like to supply the answer on the basis of the contract training.

Mr. KITCHIN. If you will.

Mr. WILLEY. On the question of awards, they are taxed like everything else.

Mr. KITCHIN. Oh, yes.

Mr. HÉBERT. In connection with what Mr. Courtney asked you, on the position of the Bureau of Internal Revenue, now let's understand

exactly what we are talking about. There is one program, the so-called cooperative program, whereby the individual is employed for 6 months and goes to school for 6 months. There, the Army has no financial concern.

Mr. WILLEY. That is right.

Mr. HÉBERT. At all.

It pays the man a salary for 6 months. The man saves his tuition out of that, and he pays for his tuition.

Mr. WILLEY. Yes, sir.

Mr. HÉBERT. Obviously, that is all taxable. Now, in the area—and I think what Mr. Courtney was asking about—where you send the individual to school for extracurricular work and pay the school; is your program that?

Mr. WILLEY. Yes, sir. For contract training we actually have a contract with the university. It is not with the individual, sir.

Mr. HÉBERT. Not with the individual.

Mr. WILLEY. No, sir.

Mr. HÉBERT. The university receives the money.

Mr. WILLEY. That is right.

Mr. HÉBERT. But the student receives the benefit of the education, tuition free.

Mr. WILLEY. That is right. This is training by contract at universities, accomplished under the same type of authority training as that performed on the job in the installation. Our training authority is contained in annual appropriation acts, currently section 603, Public Law 85–117.

Mr. KITCHIN. Is that extra taxable to the individual?

Mr. HÉBERT. That is the question.

Mr. WILLEY. I would like to supply an answer for that. I don't think it is, but I would like to supply an answer.

Mr. HÉBERT. Our recollection is in industry, we found in the airframe investigation, that the Internal Revenue Department was holding that tuition as taxable.

Mr. HARDY. That is the tuition which they pay directly to the school.

Mr. HÉBERT. That is right.

In the airframe industry, the individual was being charged, as part of his income, is my recollection.

Mr. COURTNEY. Of course, the Army program, may I say, Mr. Chairman, is slightly different from the industry program. In the case of industry, that is in the cases that were considered by the subcommittee, the money was advanced to the individual and he, in turn, paid the university for his tuition.

Mr. HÉBERT. I understand that. Here its net or end effect is the same thing.

Mr. COURTNEY. That is right.

Mr. HÉBERT. One pays the school and the other pays the man, and the man, in turn, pays the school.

Mr. COURTNEY. But this is a contractual arrangement of the Army with the university.

Mr. HÉBERT. The individual is getting his tuition paid.

Mr. COURTNEY. I think, Mr. Chairman, the record would be properly completed if the witness will give the answer as to whether or not those payments are treated as income.

Mr. HÉBERT. If you will supply that.

Mr. WILLEY. Yes, sir.

The Department of the Army has not considered tuition payments for contract training as being income to the individual employee and thus subject to tax. No situation has come to our attention where this issue has been raised by employees or by the Internal Revenue Service, although several thousand persons have received training at Government expense annually over the past decade and a half.

In response to our informal inquiry, a representative of the Internal Revenue Service advised that no clear-cut guidance could be given on the question. The only relevant portion of the Internal Revenue Code is section 117 which relates to scholarship and fellowship grants as contrasted with training provided for the employer's benefit. We are informed that that section is currently under study for revision in view of the large number of differing situations which have arisen in recent years.

Where contract training is authorized at a location other than the employee's duty station, he receives the normal per diem allowance in lieu of subsistence for official travel. These amounts would, of course, be reportable as income in the same manner as other travel allowances against which the employee may claim as business deductions the actual expenses incurred by him.

Mr. WILLEY. General Conway was talking about this Army Science Conference held at West Point last summer. One of the other elements not mentioned was that a number of these scientists and engineers in connection with the papers and the work they had done received cash awards and honorariums. Of course, they also get the recognition by the scientific community that has been indicated as being very prized.

There have been also in the Army numerous recommendations of individuals for external awards—some honorariums and some of the Rockefeller public service award type, and that sort of thing.

Mr. HÉBERT. In this area where you have 36 of your top scientists—

Mr. WILLEY. Yes, sir.

Mr. HÉBERT. I think that was the figure you used.

Mr. WILLEY. Yes, sir.

Mr. HÉBERT. How many of those top scientists are foreign born, or foreign educated, out of the 36?

Is it predominantly foreign or predominantly American?

Mr. WILLEY. No, sir, I would not say it is predominantly foreign. But I would like to give you a statement for the record on that, to supply you with the actual fact.

Mr. HÉBERT. I am talking about the Von Braun's and that category.

Mr. WILLEY. Of the 36 Public Law 313 positions currently authorized, 3 are occupied by individuals who emigrated from Germany after World War II. Two other incumbents were foreign born, but have spent all of their adult lives in the United States.

Supplementing the above, however, it must be pointed out that an additional 15 persons of the original German group occupy key scientific positions with the Army. Because of the shortage of Public Law 313 spaces, however, the positions occupied by these individuals have been established under the Classification Act at the supergrade level pursuant to authorization from the Civil Service Commission.

Mr. HÉBERT. Are you in a position now to inform the committee as to the problem of retaining these foreign-born individuals?

I understand they were first brought over here on contract, quite different to the Russian system where they were taken.

Over here, they were given a job for X number of years, and they could renew their contract; that is correct?

Mr. WILLEY. They are direct-hire civilian employees and work for the Army, like any other civilian scientist or engineer, on a direct-hire basis. They are regular employees and doing a magnificent job.

Mr. HÉBERT. Now, were they brought here at Government expense?

Mr. WILLEY. I would like to supply detailed information of that sort to you, Mr. Chairman. I don't have the information as to all the details.

Mr. HÉBERT. You see the reason for that question is: the regulation will not let you take the American and bring him to your point of origination. That is why I asked if you are allowed to do that for foreigners.

Mr. WILLEY. I want to give you the information. I don't have it here.

Mr. HESS. They found some funds for that.

Mr. WILLEY. The persons involved have been transported to the United States at Government expense under a special legal authority in title 10, United States Code, which does not extend to other recruitment efforts.

Mr. HÉBERT. What I want to know: Do you have any particular trouble in the area of the foreigners, to retain them, as compared to the American?

Mr. WILLEY. No, sir, I know of no trouble with them that is peculiar. Most of these men—in fact, as far as I know all of them, but I stand to be corrected by someone who may know more intimately than I do—are now all American citizens and they are regular employees in every respect.

Mr. HÉBERT. Well, I have in mind an article I read last July, by Jim Lucas, of the Scripps-Howard papers, purporting to be an interview with Dr. Von Braun, in which Dr. Von Braun had under serious consideration returning to Germany because the benefits were better there, in retirement, or something of that nature. It was sort of a touch and go situation.

General HINRICHS. May I speak to that point, Mr. Chairman?

Mr. HÉBERT. Yes.

General HINRICHS. I think Dr. Von Braun was referring to one of the group of German scientists down there, and not himself.

Mr. HÉBERT. But it was interpreted as being himself.

General HINRICHS. It was interpreted in that article as being himself. The particular case in point involved not entirely the money situation, but also some very heavy family commitments. There was an old mother and father. That was the real point of it, which I think was not brought out in that article, if I remember.

Mr. HÉBERT. I happened to have had contact with General Medaris at that particular time and he knew nothing about it. In fact, he didn't even know of the article. He was surprised when I informed him. But that would not be a general situation, but was quite the exception.

General HINRICHS. Quite the exception.

Mr. HÉBERT. Quite an exception.

Mr. WILLEY. Other types of recognition have been developed, in addition to these external recognitions, such as Rockefeller public service award and Flemming award and other awards of that sort. A little over a year ago Secretary Brucker initiated a program now designated as the Secretary of the Army's research and study fellowships, to specifically encourage the career attractiveness of scientists and engineers and other personnel in the Army.

Twenty-seven of these secretarial awards and fellowships have been undertaken to date, and 74 percent of them, or 20, have actually gone to scientists and engineers.

This, of course, has been——

Mr. COURTNEY. What is the source of the money and what is it in dollars?

Mr. WILLEY. An original figure of $200,000 was earmarked by the Secretary, with the approval of Congress, to undertake this program, with the idea of stimulating the best kinds of career incentive for career civil servants who are with the Army to undertake a study or fellowship program.

Mr. COURTNEY. Well, is that undergraduate or postgraduate?

Mr. WILLEY. No, that is postgraduate, at that level; yes, sir.

Mr. COURTNEY. Postgraduate.

Mr. WILLEY. It has been a very fine program.

In addition, three people who have gone have been executives, but executives concerned with scientific management. So most of these have gone to this area.

Mr. COURTNEY. Now, is that a case in which the Army contracts directly with the university or the school, versus advancing tuition to the individual?

Mr. WILLEY. Yes, sir, that would be where they would contract with the school.

Mr. COURTNEY. Directly with the school?

Mr. WILLEY. Yes.

Other programs have directed their attention to improving the utilization of the engineers and scientists to make sure that as much time as possible is spent on their journeyman or their developmental work and as little time as possible on the administrative or the procedural or the other types of work that are not essential to carrying out their primary task of research or engineering. We have had a number of very fine programs of this sort. I have already alluded the the "Man Friday" program. There are other programs of providing them with administrative support personnel, to relieve them of this kind of work. The Deputy Chief of Staff for Logistics has carefully and very thorouoghly reviewed the supply procedures, to make sure that there is no bottleneck to the getting of supplies and materials necessary to their proper performance.

A new program that has recently been initiated is what we call the skills utilization index. Every job in the classified service is to be reviewed once a year to make sure that it is properly allocated. In the course of this review, if it involves scientific or engineering duties, under our skills utilization index procedure, we take a look to see what proportion of time the individual spends on this developmental or engineering work. So we get another check on the amount

of effort that goes into the proper use of these engineers and scientists.

We think that the most important program of all is to have a carefully organized and actively sponsored career program that will operate on the widest organizational basis, that will provide a systematic input and the man with the proper development through rotational assignments and the possibility to rise right to the top of the ladder in his profession, in order to not only attract the high caliber people but to use them most effectively and to make sure we have proper retention of the skills we need.

This is where we are placing our emphasis and most of these things I have just described are parts of this program.

In summary, I would like to say that I think we have the same kind of difficulties as any other large employer. Our current vacancies as of the end of December were 608. That is a substantial number.

Mr. COURTNEY. 608 of what?

Mr. WILLEY. Of our scientific and engineering.

Mr. COURTNEY. Of a total of what?

Mr. WILLEY. Of a total of 11,000 in the research and development field, including construction and civil engineering and others.

Now, this 608, of course, is a substantial figure, but we don't think is a critical figure in terms of the total perspective.

Mr. COURTNEY. What is your rate of attrition within this bracket of 21,000?

Mr. WILLEY. Well, we reviewed this very carefully back in our research and development survey. We were pleased, as I indicated, to find that we have a lower quit rate for our research and development personnel than we had for our regular personnel. It was 9.9, less than 1 percent a month.

Mr. COURTNEY. Now, you have eleven thousand-odd in research and development, and the balance in Corps of Engineers are concerned.

Mr. WILLEY. Right.

Mr. COURTNEY. The civilian branches of the Corps of Engineers I would assume probably take the better share of that?

Mr. WILLEY. That is right.

Mr. COURTNEY. Now, what is your rate of attrition within the 11,000 and in what different brackets, if you know?

Mr. WILLEY. Well, I can't give you a breakdown as to brackets, but as of 1956, when we reviewed this very thoroughly, the turnover for the quit rate, or the loss rate, that is people who left us voluntarily, was 9.9 percent, for that 11,000.

Mr. COURTNEY. Annually.

Mr. WILLEY. Annually, that is right.

Mr. HÉBERT. You had a fine record there. The airframe industry was 17 percent plus.

Mr. WILLEY. Mr. Chairman, we think this is a fine record and we think this is proof positive of the kind of attention that the Army has been directing to this problem. We think, moreover, we are able to get good people because of this kind of effort and because Army has a reputation of being a good place to work.

One thing I think will interest the committee, is that better than 30 percent of the new people that come to us come to us as a result of a contact with a current Army employee. In other words, our current employees are our best salesmen for our work.

We have, of course, brochures that we use. But actually, current contacts, people who now work for the Army, is our best recruitment source. We apply them all, but this is one——

Mr. COURTNEY. Mr. Willey, could you supply for the record, if you have the information, the grades within which this 9 percent attrition occurs? Is it at the top, in the middle, or where?

Mr. WILLEY. I will get some information on that point.

Mr. COURTNEY. If you will.

Mr. WILLEY. My memory is—and I would like to supply details on it—that it occurs primarily toward the top, where the low ceiling is being forced down on them.

Mr. COURTNEY. That would be the issue, as to where this attrition is occurring.

Mr. WILLEY. Right.

Mr. COURTNEY. And why.

Mr. WILLEY. The Department does not have complete data as to the number of voluntary quits by grade which would permit us to provide a quit rate for each salary level. However, the sample of approximately 500 separated employees identified in our 1956 survey indicates that separations occur roughly in proportion to the grade distribution of the total scientific and engineering population, as follows:

Grade	Percent of total strength at 14 installations	Percent of total quits	Grade	Percent of total strength at 14 installations	Percent of total quits
GS-5	3.2	3.3	GS-13	15.4	8.5
GS-7	7.1	9.8	GS-14	6.7	3.8
GS-9	13.9	17.8	GS-15	2.4	2.2
GS-11	26.7	35.1			
GS-12	24.6	19.5	Total	100.0	100.0

Mr. HESS. Have these vacancies been increasing or decreasing over a period of years, the 608 I think it was that you mentioned?

Mr. WILLEY. Yes, sir. They have kind of a wave pattern, depending upon a lot of things—depending upon the employer's market, depending upon the availability of graduates, and some of these other things.

Mr. HESS. And depending on the expansion of the program, too, probably.

Ms. WILLEY. Yes, sir; expansion of the program. But the vacancies have come down generally in the past year. We are working very aggressively at this program.

Mr. HÉBERT. Would that have any connection at all with the unemployment rate in the country having gone up, that your spots are being filled?

Mr. WILLEY. There is some softening, Mr. Chairman, in the employer's market. I don't know that it is the result of unemployment, as it is a combination of fewer employment prospects for the graduates that are coming out of the universities, as well as other factors.

In summary, I would like to say that we think the problems that are beyond our control are those that are related primarily to pay and we hope that there will be some favorable congressional action. We are going to continue to emphasize the importance of personnel management for these scientists and engineers.

This concludes my comments. I would be very happy to answer any questions.

Mr. HÉBERT. I want to ask you: In the people that you are losing to industry, in that area, the industry to whom you lose your people are Government contractors for the better part, aren't they?

Mr. WILLEY. I would be unable to say that categorically. I would presume that a good portion of them are because of the kind of work the people have been engaged in. But I couldn't mean——

Mr. HÉBERT. I mean that. But you are losing them to some other people the Government is still footing the bill for. The Government's price is running up because you have Government money competing against Government money.

Mr. WILLEY. Well, this is, of course, a situation that insofar as I know the industry—some of the large industries pay the same rates in their contractor-type operation as they do in their own direct-hire operations, in other words, those people that are not engaged in Government contracts. I presume this is the case. But we haven't attempted to analyze, at least I haven't attempted to analyze it from your standpoint.

Mr. HÉBERT. I think that is a factor there, a great factor. For instance, in the airframe industry, practically 98 percent of them have only 1 customer and that is the Government, and they are drawing the scientists and engineers away from the Government.

Mr. COURTNEY. And from each other.

Mr. HÉBERT. And from each other. And the taxpayer is footing the bill.

Mr. KITCHIN. They are drawing them from the Government, increasing the salary, and then adding that on to the cost of the contract.

Mr. HÉBERT. Yes; to the cost of the contract. It would be perhaps more economical to pay them when they are in the Government service.

The next witness.

Mr. COURTNEY. Mr. Chairman, Gen. C. W. G. Rich will speak with reference to the uniformed personnel of the Army. General Rich has a prepared statement.

STATEMENT OF BRIG. GEN. C. W. G. RICH, OFFICE OF THE DEPUTY CHIEF OF STAFF FOR PERSONNEL, DEPARTMENT OF THE ARMY

General RICH. Mr. Chairman, I am Brig. Gen. C. W. G. Rich, Office of the Deputy Chief of Staff for Personnel for the Department of the Army. I am very pleased to have this opportunity to present the Army programs on the procurement utilization and development of military personnel in the scientific and engineering fields.

I have a prepared statement, Mr. Chairman, which I would like to introduce into the record. In the interest of your valuable time, I am prepared to give a brief of this statement.

Mr. HÉBERT. The statement will be introduced into the record as having been read at this point.

(The statement is as follows:)

General RICH. Mr. Chairman, I am Brig. Gen. C. W. G. Rich, Office of the Deputy Chief of Staff for Personnel, Department of the Army. I am pleased to have this opportunity to present the Army programs

for the procurement, utilization, and development of military personnel in scientific and engineering fields.

The Army has a growing need for officers with advanced knowledge in scientific and engineering fields. The Army's requirement is for officers who are militarily trained but who also have sufficient advanced training in scientific fields to recognize and cope with problems related to their military duties and who are capable of working with civilian scientists, translating military requirements into scientific terms, and directing research and development in military fields.

However, the Army depends on Army civilians or civilian contractors to perform basic research in scientific fields. Thus, the Army's requirement is for officers who are primarily qualified as Army officers and who in addition have scientific and engineering knowledge.

The nationwide shortage of scientifically trained personnel hampers the Army's efforts to attract such personnel. The Army has two procurement programs to obtain Regular Army officers with postgraduate training in scientific and engineering fields. A technical specialist program which operates under normal legislative authority provides for the commissioning of officers in the grade of lieutenant direct from civilian status who have degrees and experience in one of the many technical specialties listed as critical to the Army. These officers must possess master's or doctor's degrees from accredited colleges and universities.

In 1956, the Congress recognized the Army's need for scientifically trained personnel, and approved as part of the Regular Officer Augmentation Act, the appointment of 200 outstanding specialists in critical fields in accordance with criteria prescribed by the Secretary of the Army, and approved by the President.

To establish eligibility, applicants were required to possess either a doctor's degree, or a master's degree with 3 years of practical experience in a field directly related to the specialty, or a bachelor's degree plus 5 years' postgraduate experience directly related to one of the fields of specialization. Twenty critical fields were approved.

The success of this program has not been determined, although the Army at this time is examining the records of 172 eligible applicants. Wide publicity was given to this program and although there were 201 applicants some did not meet the established eligibility standards.

The Army has no school, college, or university which grants advanced degrees. The Army's requirement for officers with postgraduate training is met primarily through the civil schooling program; that is, militarily qualified officers attending civilian institutions for graduate level training. In this way, the Army trains officers who have generally demonstrated an aptitude for an above average job performance and a desire for extended active duty.

The program is voluntary, encouraged, and highly selective. Officers are trained at Government expense and in turn are obligated not to seek release from the service until at least 4 years after completion of such training, which includes at least one 3-year utilization tour.

Officers accepted for civil schooling are normally entered into such schooling between the second and eighth year of service.

The Army has established a research and development and atomic energy specialization program as an aid in meeting requirements for

personnel trained in engineering and physical sciences. The primary features of this specialization program are that officer volunteers accepted, are assured repetitive research and development or atomic-energy assignments, interspersed with branch qualifying tours. Inherent to the program is centralized monitorship of assignments of officers trained in critical fields of graduate study.

This program is providing a sound vehicle for improving our posture with regard to training and utilization of scientifically trained officer personnel.

The Army is also particularly cognizant of its responsibility for the proper utilization of enlisted scientific and engineering manpower not only to meet its own requirements, but to serve the best interests of the Nation and the individual. To this end, the Army established several years ago a scientific and professional personnel program to insure the best utilization of its scientific and engineering talent.

Draftees and enlistees who are college graduates and have specific technical qualifications are earmarked as they pass through reception stations for the scientific and professional personnel program.

After completion of 8 weeks' basic combat training, these personnel are assigned to Army research or testing facilities where their talent and training can be used. They serve in apprentice positions to assist scientists and engineers. If no such requirement exists, the individual is assigned to an Army unit which has a requirement for a specialty generally related to the civilian training of the individual.

In the latter case, the individual remains eligible for reassignment to a more advanced technical position if such a vacancy exists. Today there are approximately 5,000 enlisted personnel in the program. Thus the Army benefits by capitalizing on the draftee's potential and talent while the draftee is able to continue work related to his future civilian vocation while filling his military obligation.

One of the major problems faced by the Department of the Army is to find ways and means to attract, train, and retain sufficient qualified enlisted personnel capable of operating and maintaining modern military equipment. As one measure to meet this need, and to provide a retention incentive for quality enlisted personnel, the Army has approved an improved educational plan for enlisted personnel to obtain college-level training at civilian institutions in return for obligated service.

Although legislative authority has permitted such training, additional information to the field was needed to encourage greater participation in the program.

In summary, these programs have done much to alleviate the shortage of scientific and engineering military personnel. Although the Army's requirements are expanding, greater emphasis is being placed on these programs and no additional legislative authority appears necessary at this time.

Mr. HÉBERT. General, you may summarize.

General RICH. Mr. Chairman, the Army needs officers with advanced knowledge in the scientific and engineering fields. This requirement is for officers who are primarily qualified as Army officers and likewise have scientific and engineering knowledge.

We have two programs that we use to obtain such officers.

The first one is called the technical specialist program, which we have had in being for some time, which permits the obtaining of these

individuals in the lower grades. We also have what is known as the P–200 program, which is part of the Regular Army Augmentation Act, which was passed a little over a year ago, in which we may obtain officers in all grades. And this program permits the commissioning of certain outstanding specialists with advanced degrees and/or certain experience in the field of their specialty.

The Army does not have a postgraduate school at which an individual can get an advanced degree. Therefore, our officer requirements within the service have to be accomplished through our program of civilian schooling. The participants in this civilian schooling are volunteers who are in their early years of service, and who may not be released from the service until 4 years subsequent to their completion of such schooling.

Also within the Army itself we have a specialist program which permits an officer to serve repetitive tours, in such fields as atomic energy or research and development, with an occasional branch qualifying tour to keep him abreast of strictly military business.

In recognition of our responsibility for proper utilization of enlisted personnel in this same area, the Army also has two programs.

The first is called the scientific and professional personnel program, in which we identify those enlisted or inducted personnel when they are brought into the service, who have special training and which we may be able to use either in whole or in part.

Currently we have over 5,000 individuals in this program who are being so utilized.

The second program which we have just recently instigated deals with those personnel who do not have this advanced knowledge, but whose job requirement calls for it due to the evolution that we are going through in our Army from a technological point of view.

Here we send these individuals to civilian schooling for up to 4 years possibly, and this is on the basis of a 2 for 1 return in obligated service—1 year of schooling and 2 years' obligated service.

This permits the individual to advance further in the job field, to be of greater value to the Army, and, of course, this in turn improves our operational readiness. An example would be the Nike program where we have many specialized requirements.

In summary, we feel that in spite of our expanding requirements, these programs, plus the current legislative proposals to include the current pay proposal, will make service in the Army sufficiently attractive to obtain and retain that high quality type individual which we feel that we need to make our Army the best army in the world.

That concludes my summary. I am prepared to answer questions.

Mr. HÉBERT. Now you say you have 5,000 individuals in this program, General.

General RICH. In the scientific and professional personnel program—over 5,000, sir.

Mr. HÉBERT. How does that reflect against the applicants for those spots? Are you saturated with 5,000?

General RICH. Mr. Chairman, I would say that maybe any individual who had a college education thought he was an applicant for such a spot. We have an identifying process in which we determine, one, that the individual's education is such that we can use him all of the time, or two, that we have an area in which we can use him in part, or three, that we have no use for him as a specialist.

The total that I gave you includes the first two areas. We call them type A and type B. Type A, as an example, would be a nuclear scientist. Type B might be a man with a B. A. degree, in which we could use him in certain tangential areas, but not 100 percent in his specialty.

Mr. HÉBERT. The Navy testimony, as I recall it—this is from memory—for instance, there was an allotment to the Marine Corps of some 20 vacancies.

(Mr. Hess aside.)

Mr. HESS. These are officers with degrees?

General RICH. No, sir; I am talking about enlisted men who are in the scientific and professional program.

Mr. HESS. Oh.

Mr. HÉBERT. For instance, the Marine Corps had 20 openings and applicants for 2,000. It was 6,000 for the whole program, of some two-hundred-plus. Broken down it was 2,000 marines for 20 slots. Do you have anything on that?

General RICH. I am informed, sir, that we have 6,100 people who represent the 5,317 that are the ones that are being utilized. That represents the screening of the 6,100.

Mr. HÉBERT. Sixty-one, and you have fifty-one.

General RICH. No, sir——

Mr. COURTNEY. Sixty-one for five thousand spots.

General RICH. We have a total of 5,317. We have requirements in which we think we can use 4,350. The type A individual: We have 3,676, and in type B we have 1,641. The type A is the complete utilization and type B is partial.

Mr. HÉBERT. No. What I am trying to develop is—you obviously do not have any difficulty in filling these slots?

General RICH. No.

Mr. HÉBERT. But do you have a terrific average, that if you had the space available or the funds you could use even more?

General RICH. Well, let me put it this way, Mr. Chairman: We have a requirement of 4,350. We have a type A individual of 3,676. If we had the difference, which is 500 plus, of a particular category, we could use those. But counting them in all the categories, we have more than we can use.

Mr. HÉBERT. I see.

General RICH. But not any great number.

Mr. HESS. Mr. Chairman, I would like to clear this in my own mind, General. You have some boys who are going to college taking postgraduate courses. They have received degrees, before they came into the service; is that correct?

General RICH. Yes, sir.

Mr. HESS. Now you have others who are either draftees or enlisted men who are going to college to get their primary degree; is that correct?

General RICH. Yes, sir.

Mr. HESS. They are two entirely different classes there. The one group that are going to college to get a degree: They are compelled to enlist for a certain period of time. They have 2 years' training and then they give a certain amount of time to the Army after that. Then they come back and have 2 more years' training and give a certain amount of time to the Army after that; is that correct?

General RICH. Yes, sir.

Mr. HESS. Now, how many do you have in that program?

General RICH. Mr. Hess, we have just introduced this program.

Mr. HESS. I see.

General RICH. Actually at this moment we have three individuals previously from a special program from the Signal Corps. This program, of which I spoke, was just announced within the past 2 weeks.

Mr. HESS. I see. And what college are you using for that, or colleges?

General RICH. It will depend on the number of applicants we will get, Mr. Hess. We now have programed 300. General Hinrichs, the Acting Chief of Ordnance, has been allocated 50 of these individuals. So I would say we are in the prototype area right now, until we find out the reaction of the program, so we will know how many we will get into it.

Mr. HESS. That is on a voluntary basis?

General RICH. That is right, sir.

Mr. HESS. That is all.

Mr. HÉBERT. Now you are not taking into consideration your ROTC officers, are you, in this?

General RICH. No, sir; all we are talking about here, sir, are enlisted personnel, on the questions that I have been responding to.

Mr. HÉBERT. Now how about your officer personnel, where you get the ROTC student who is obligated for 2 years' service after he gets his commission at the private school?

General RICH. Are you talking about his utilization from this scientific and professional program aspect, sir, or for the civilian schooling program, sir?

Mr. HÉBERT. I am talking about his prospect as a scientist or engineer in advanced studies, what he can contribute to the program.

General RICH. Yes, sir; we utilize those. But generally speaking, we acquire the people in that area through our civil-schooling program. In other words, as an example, we now have over 1,000 people in the civil-schooling program, which is divided about 50–50 between social sciences and physical sciences. And when you consider the utilization of the individual, we have to look at it from a long-term point of view. Maybe what I am saying is that the utilization of the ROTC individual doesn't pay off much.

Mr. HÉBERT. That is what I want to find out. Does it pay off?

General RICH. Well, let's get into the numbers business. We will graduate somewhere in the vicinity of 12,000 ROTC boys. About half of those will come to active duty for 2 years and the other half for active duty for 6 months.

Those individuals that are in the technical services who have advanced degrees and who come to duty for 2 years will be utilized.

As an example, General Hinrichs will utilize every one of those who come to duty in ordnance. If an individual comes to active duty for 6 months in the artillery, as an example, he goes to his basic school to qualify him in artillery, since he probably takes a general military science course at ROTC. He doesn't graduate until 4 months. So he only has 2 months' duty left.

The individual who is in for 2 years will be utilized in combat arms, but generally speaking only in that area which might be tangential to his normal-duty assignment.

As an example, we would not take a lieutenant of artillery who might have some special degree and send him to Fort Sill or Los Alamos or some place like that. You would send a man there who had advanced schooling and whom you could expect to utilize for at least 3 years.

Mr. HÉBERT. Well, is any effort being directed to some of these ROTC students who graduate around in the area of 11,000 or 12,000 a year?

General RICH. Yes, sir.

Mr. HÉBERT. Where they do have some scientific background. All of them have not the sciences in ROTC. As you just suggested, they just have a general idea of military science in whatever school they come from. They are not necessarily adapted to advanced courses in science and engineering. But do you screen these individuals and try to get some utilization out of them?

General RICH. Yes, sir. Each branch looks over the individual's qualifications from the point of view of how much schooling he has had or what he can add to the military, and then he is used against a requirement which the branch has, and the best fitted individual is sent to the job of the highest requirement.

Mr. HESS. I have a question. General, how many of the 11,000 or 12,000 who enter the Army every year out of ROTC remain with the Army?

General RICH. Our retention rate, Mr. Hess, is about 20 percent. This represents an increase over the past 2 years we have been working on this, and our optimum rate that we would like to get to is about 35 percent.

Mr. HESS. Now when a boy expresses a desire to remain in the Army and might express a desire to go to MIT and take a post-graduate course in engineering or something of that kind, would you give him an opportunity to do that?

General RICH. Yes, sir. We would particularly like to have him. If we feel that he possesses an above-normal academic background—we go into that to see that he has a capability of doing this.

Mr. HESS. Well, is that being made known to the boys when they come in from ROTC?

General RICH. Yes, sir.

Mr. HESS. They know of these programs and the opportunities that they have?

General RICH. And that is a part of the program in the ROTC, or on the campus, itself, by the professor of military science and training.

Now we have this program, project No. 200, which we are utilizing to procure 200 specialists, which was given to us by Congress in the augmentation act.

We have the other program called the technical-specialist program, in which we have been requiring individuals with either master's or doctor's degrees or part of same with a certain period of utilization which would be a constructive equivalent of what he lacked.

Mr. HÉBERT. In other words, they are sold on the campus before they actually get into the Army—or rather an attempt is made to sell them.

General RICH. An attempt is made to sell them. Actually we think the biggest selling job, Mr. Chairman, is made after the indi-

vidual is in the service. Because on the man who does not become a Regular Army man initially but comes on active duty for 2 years—that is when you have to do the selling job.

I might indicate that that is one of our most competitive areas for commissioning Regular Army officers. We take in approximately 1,800 officers a year, of which 400 plus comes from the Military Academy and about 800 plus comes from the distinguished military graduating program of the ROTC, and the remainder come from what we call our active duty program. That is the man who has been on duty for a year or 18 months or 2 years. And that is a very competitive program.

Three years ago only 1 out of 6 applicants was successful. Since then the number that we have taken has increased and it is still about 1 out of 3.

Mr. HÉBERT. So there is no dearth of material there?

General RICH. Not for the Regular Army commission. But the number that we want to retain on active duty is a much larger number and we do have trouble there. That is where we are only retaining about 20 percent.

Mr. HÉBERT. What was the academy rate of resignations?

General RICH. 25 percent, sir.

Mr. HÉBERT. 25 percent.

General RICH. For the class—if we project it to the next 2 years so they will have 5 years of opportunity, the class of 1954 will have resigned at the rate of 25 percent.

Mr. COURTNEY. That is 4 years' obligated service?

General RICH. The Army is only three, Mr. Courtney.

Mr. COURTNEY. Three, that is right.

General RICH. It is in the process now of being changed to 4 years.

Mr. COURTNEY. Then, what you are saying is statistically this: After the end of the obligated service, your rate of attrition is roughly 25 percent, is it?

General RICH. Yes, sir. But to modify that a little bit, 3 years is the first time he can resign.

Mr. COURTNEY. Yes.

General RICH. So we will check him at 3 years, 4 years, and 5 years.

Mr. COURTNEY. Yes.

General RICH. We have found that after 5 years his resignation rate is normal with the rest of the service.

Mr. COURTNEY. Meaning what?

General RICH. So those are the 3 critical years.

Mr. COURTNEY. Meaning what?

General RICH. Oh, 1 percent a year, whereas you get 25 percent in 3 years.

Mr. COURTNEY. Yes.

General RICH. After that it is 1 percent a year.

Mr. KITCHIN. I gather from that statement it would be better if we had a longer obligation for those boys.

General RICH. Mr. Kitchin, that is a normal conclusion to arrive at, sir. But we don't believe that that is true. The Navy has 4 years and they have just about the same problem we do. I think if you put it up to 5 years, then in the fifth and sixth year—I grant there must be a point of no return somewhere, but we are trying to keep a volunteer service. We aren't keeping that man 3 years to really hold him in

there. We are really trying to get a little repayment against what we put into him. We would like to have a volunteer officers corps 100 percent.

Mr. HÉBERT. Of course that would be the ideal situation, but humans being what they are, and individuals being what they are, you are not going to have them.

General RICH. Yes, sir. But where do you get the proper balance, Mr. Chairman, between these two?

Mr. HÉBERT. I see.

General RICH. We feel that either 3 or 4 years would probably be the proper place.

Mr. HÉBERT. I agree with you that the basic philosophy, the basic objective should be to get some money out of that fellow you have been investing it in, that is, get some interest in it.

General RICH. And it is our job that we convince him that the Army is a good place to serve within the 3 or 4 years. We have to do that, and if we don't have all the means to convince him, we come to you and ask you for a few things to help us convince him.

Mr. HÉBERT. Well, that is continuous. [Laughter.]

Mr. KITCHIN. Looking at it purely from the selfish standpoint of the individual, I have been told that based on the experiences among the congressional appointments to the Military Academy, that normally a boy can go to college and he knows after he gets out he is going to have 2 years' obligation.

Why not let the Government pay for his education and serve 1 more year. And he gets an education there that couldn't be purchased for many thousands of dollars, and has only 1 year longer obligation to serve his country. Now, that is something that we have been a little concerned about.

General RICH. Yes, sir.

Mr. KITCHIN. As a matter of fact, I had and still have, notwithstanding the statement you just made, the idea that probably we ought to increase the length of obligation from all of the Academies.

If we are going to give him a free education and get him out, he ought to serve his country in the capacity to which he has been trained for a longer period than just a little bit more than the obligation that is on everybody else.

General RICH. Yes, sir.

I might give you another statistic to compare in this. The distinguished military graduate resignation rate in 1950 and 1951 was 42 percent or thereabouts. It is now about 10 percent. It has come gradually down.

Mr. HÉBERT. So you are retaining them?

General RICH. So, overall, our retention is in the vicinity of about 12 or 15 percent since the Military Academy procurement program only represents approximately four-eighteenths at the current sitting of our total Regular Army officer program.

Mr. HÉBERT. Yes, but you have, to back up that program, General, the ROTC and in the Navy you have the so-called Holloway program, which is more demanding than I think the ROTC program.

General RICH. Well, by inverse tactics I was trying to bring out that our DMG program has a big return as against some subsidized program, such as the Holloway program or some other program, and that we do have a 90-percent retention rate in the DMG area. And

we feel that the Military Academy retention rate will improve. We have taken very positive steps in the past few years.

Mr. COURTNEY. You are not talking about the United States Military Academy?

General RICH. No, sir, I was relating the fact that we now have a 90-percent retention rate in the DMG program. But we feel that the steps we have taken concerning the Military Academy graduates are going to arrest and reduce this attrition rate that we have just been speaking about, of 25 percent.

Mr. HÉBERT. General Beach.

STATEMENT OF MAJ. GEN. DWIGHT E. BEACH, DIRECTOR OF GUIDED MISSILES, OFFICE OF THE DEPUTY CHIEF OF STAFF FOR MILITARY OPERATIONS, DEPARTMENT OF THE ARMY

General BEACH. Mr. Chairman, I am Maj. Gen. Dwight E. Beach, Director of Guided Missiles in the Office of the Deputy Chief of Staff for Military Operations, Department of the Army.

I consider it a privilege to appear here before you to discuss missile training as an illustrative example of our Army training problems.

(The prepared statement is as follows:)

Mr. Chairman, great emphasis has been placed upon the ultimate economy of missile-weapons systems in reducing the requirements of the Army for enlisted manpower. However, like all generalities, this one should be examined carefully. Missile units have far greater destructive potential than the conventional gun units which they replace—and in this sense a saving in personnel may accrue. However, these units represent a far greater investment both in dollars and in the skills represented by their personnel, than any units activated in the Army prior to the present time.

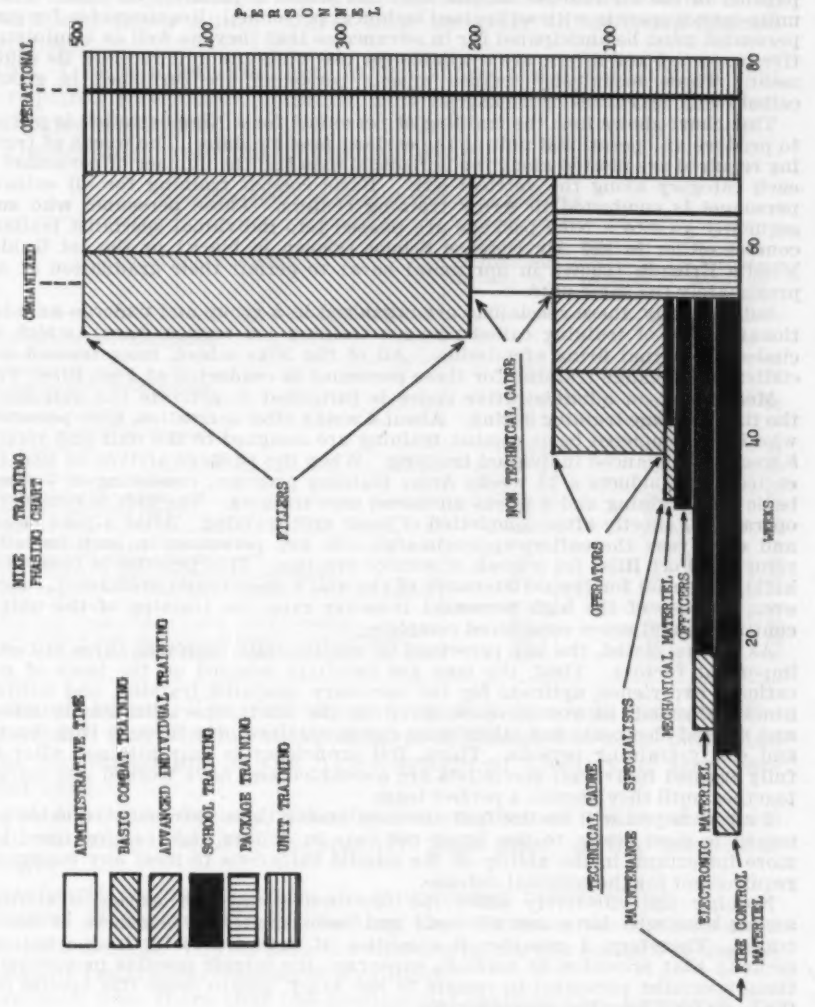
It is my purpose to bring to your attention what I believe to be the most important problem of the many problems related to these new missile organizations—the provision and maintenance of the highly skilled personnel necessary for their deployment, operation, and maintenance.

The missileman is given the same type of basic training that all soldiers in the Army receive. The remainder of his individual training is given in Army service schools or in troop units. Those trained in service schools, while few in number, require a high level of technical ability to perform their missions effectively. These include combat arms or "user personnel," who maintain and fire the missiles, and the technical services personnel, who supply the missiles and perform repairs beyond the capabilities of the user personnel. These technicians are referred to as school-trained specialists. The training of the larger part of the missile personnel, who require a relatively low skill level, is accomplished in missile training centers and troop units. These men are called troop-trained specialists.

This handout shows enlisted skills required to operate, maintain, and repair the various Army missile systems. The third and fourth columns indicate the two major problem areas connected with missile training, the length of training courses required and the relatively short period of utilization of personnel after they are trained.

You will note that the training time for these specialist missile weapons skills vary rather substantially. Thus, in the mechanical maintenance of the Corporal a skilled specialist may be trained in 8 weeks. The electronic materiel maintenance specialist requires much longer training—the Nike electronic technician completing a 37-week school training course and the Corporal technician requiring 28 weeks for proficiency. Most difficult of all the skills in this critical area are those of the fire-control maintenance technician—the experts on the radar and computer—whose advanced school training requires 32 weeks for the Corporal and 47 weeks for the Nike.

In this connection I want to call your attention to the estimated annual replacement rate in the fourth column which, as you will notice, is in no case less than 35 percent of the total requirement, which in the majority of the cases is


MIX TRAINING PHASING CHART
ADMINISTRATIVE TIME
BASIC COMBAT TRAINING
ADVANCED INDIVIDUAL TRAINING
SCHOOL TRAINING
PACKAGE TRAINING
UNIT TRAINING
PERSONNEL
500
400
300
200
100
80
60
40
20
WEEKS
OPERATIONAL
ORIENTED
FILLERS
NON TECHNICAL CADRE
OPERATORS
TECHNICAL CADRE
MAINTENANCE SPECIALISTS
MECHANICAL MATERIEL OFFICERS
ELECTRONIC MATERIEL
FIRE CONTROL MATERIEL

over 50 percent of the total and which in one instance reaches the extreme rate of 78 percent of the total requirement. I think it is quite obvious that such attrition must inevitably produce an unacceptable situation in terms of cost, training, and the ability to maintain efficient units.

It should also be added that the attrition among the skilled electronics and other support personnel is in some cases even greater than that shown for the skills on this handout.

To illustrate how training is accomplished for a particular missile-weapon system, I will use the Nike air defense artillery missile battalion. Rapid expansion in the air defense missile field has placed a premium on time. These units cannot operate without trained technical personnel. Requirements for such personnel must be anticipated far in advance so that they, as well as administrative personnel and fillers, are available for use when the unit receives its equipment. These technically trained missile personnel are furnished in groups called technical cadres or packages.

This chart shows how the training of personnel for a Nike battalion is phased to produce an operational unit at the earliest possible date. The weeks of training required are plotted along the horizontal axis and the number of personnel in each category along the vertical axis. Basic combat training for all enlisted personnel is conducted in Army training centers. Those personnel who subsequently go into a Nike package are phased into individual specialist training courses either in the Air Defense School (shown in black) or the 1st Guided Missile Brigade (shown in horizontal bars) to permit their graduation at approximately the same date.

Subsequently, these specialists are organized in a group and undergo an additional period of training called package training (in vertical bars), which includes the actual firing of missiles. All of the Nike school, troop-trained specialist and package training for these personnel is conducted at Fort Bliss, Tex.

Meanwhile, an administrative cadre is furnished to activate the unit about the time package training begins. About 4 weeks after activation, filler personnel who have completed basic combat training are assigned to the unit and receive 8 weeks of advanced individual training. When the package arrives on site, the entire unit conducts a 13 weeks Army training program, consisting of 7 weeks basic unit training and 6 weeks advanced unit training. The unit is considered operational shortly after completion of basic unit training. After a year on-site and each year thereafter, approximately 160 key personnel in each battalion return to Fort Bliss for a week of service practice. This practice is considered highly essential for the maintenance of the unit's operational proficiency. However, because of the high personnel turnover rate, the training of the unit is continuous and never considered complete.

As I have stated, the key personnel of missile units represent three critically important factors. First, the men are carefully selected on the basis of educational experience, aptitude for the necessary specialist training, and military fitness. Second, as you have observed on the chart, specialization in missile and related electronic and other skills can be attained only through very lengthy and costly training periods. Third, full proficiency is only attained after the fully trained individual specialists are assembled and have worked and learned together until they become a perfect team.

I am sure you will realize that attrition among these extremely valuable personnel is most costly to the Army not only in dollars and training time, but, more important, in the ability of the missile battalions to meet any emergency requirement for the national defense.

Nothing can effectively offset the destructive effect of excessive attrition among men who have met all tests and become effective members of missile teams. Therefore, I consider it a matter of urgent priority in the national security that provision be made to encourage the largest possible proportion of these specialist personnel to remain in the Army, and to make this special field the basis for a longtime career service.

General BEACH. Probably the most important problem of the many related to these missile organizations is the provision and maintenance of the highly skilled personnel necessary for their deployment, operation and maintenance.

The missileman at the start is given the same type of basic training that all soldiers in the Army receive.

The remainder of his individual training is given in Army service schools or in troop units.

Those trained in service schools, while few in number, require a high level of technical ability to perform their missions effectively.

These include combat arms or user personnel who maintain and fire the missile and the technical services personnel who supply the missiles and perform repairs beyond the capabilities of the using unit.

These technicians are referred to as school-trained specialists.

The training of the larger part of the missile personnel, who require a relatively low level of skill, is accomplished in missile training centers and troop units. These men we refer to as troop-trained specialists.

Now, I have a handout here which shows the enlisted skills that are required to operate, maintain and repair the Nike and the Corporal missile systems.

(The document referred to is as follows:)

Enlisted skills in missile weapons systems

Combat arms specialists	Military occupational specialty No.	Weeks of individual specialist training	Estimated annual replacement rate percent 1958
Mechanical materiel maintenance:			
Nike-Hercules	221.2	13	38
Corporal	222.2	8	50
Electronic materiel maintenance:			
Nike-Hercules	223.2	37	35
Corporal	224.2	28	50
Fire-control materiel maintenance:			
Nike-Hercules	227.2	47	40
Corporal	228.2	32	42
Technical services specialists:			
Corporal doppler repair	241.1	23	63
Corporal computer repair	242.1	22	52
Corporal radar repair	243.1	30	64
Corporal internal guidance repair	244.1	24	78
Corporal mechanical systems repair	432.1	14	59
Nike launcher control system (Ajax-Hercules)	251.1	20	56
Nike acquisition radar and computer systems repair (Ajax-Hercules)	252.1	36	61
Nike track radar system repair (Ajax-Hercules)	253.1	35	55
Nike internal guidance systems repair (Ajax-Hercules)	254.1	23	53
Nike mechanical system repair (Ajax-Hercules)	433.1	10	55

General BEACH. The first column on this handout indicates the type of skill and whether it is related to a Nike or Corporal battalion.

The second column is the Army system of identifying that particular skill.

Now, the third column indicates the number of weeks of special school training required to qualify that man in his particular specialty.

The fourth column indicates the replacement rate for 1958.

General HINRICHS. He is counting the names as the first column.

General BEACH. If you take the third column, the column is headed "Weeks of Individual Specialist Training."

You will note there that the mechanical maintenance personnel for a Nike-Hercules unit requires 13 weeks of training and 8 weeks for a Corporal.

The more difficult training, such as the electronic maintenance man for Hercules, will require 37 weeks of training, and for a Corporal 28 weeks.

The most difficult of all is that training involving fire control of missile systems, radars and computers. For a Nike-Hercules fire control maintenance man requires 47 weeks of training, and for a Corporal 32 weeks.

Now, the other items down that column are self-explanatory, indicating the number of weeks training required to qualify an individual in that particular skill.

The last column, the fourth column, indicates the expected replacement rate for 1958. The lowest rate, you will notice, is 35 percent.

The majority are over 50 percent. In one case, if you will look down that column, for a Corporal internal guidance repairman, we expect to replace 78 percent of them in 1958.

Mr. HESS. Why is that, because their enlistments expire or are they——

General BEACH. They are not reenlisting, that is correct.

Mr. HESS. That isn't very attractive, then, as a repairman for a Corporal internal guidance system, if 78 percent of them leave.

General BEACH. That is right.

Actually, on this, there are only two of those individuals in a Corporal battalion. We have 12 battalions.

As it happens, most of them have their enlistments expire in this year, sir, 1958.

Mr. HÉBERT. Well, of course your percentage figures there, General, are a little misleading, since you mentioned the fact—the numbers are the things that count. Percentages are a little misleading.

General BEACH. That is right. But to train these people requires a special instructor group, that is, a school, and you put a year's training in them. The basic reason is——

Mr. HÉBERT. They get better jobs outside?

General BEACH. They get better jobs out in industry, because they are trained in certain skills that industry wants.

Numberswise, they are not too large, but in skills they are, and the time that it requires to train them.

Mr. KITCHIN. The activity of that type technician is such that he must have a certain time or a certain amount of his obligation indoctrination in general Army procedures and in administration, and so forth.

General BEACH. He has to have——

Mr. KITCHIN. You can't take a brand, spanking-new technician out here——

General BEACH. We are talking about only a regular Army enlisted man. We do not put any inductees in. The term of service is too short. These are at least 3-year men.

Mr. KITCHIN. I see. It takes 24 weeks to train them, under your column here?

General BEACH. That is just the specialist training. Prior to that time, he has had his basic training.

Mr. COURTNEY. Eight weeks, or 16 weeks, whatever it is.

General RICH. Eight weeks.

General BEACH. Eight weeks, right.

Mr. HESS. General, I imagine in a lot of these categories here, such as the fire control materiel maintenance man, the boy must have a pretty high I. Q. for that, too?

General BEACH. Some of them do, yes, sir.

I would like to illustrate.

Mr. HESS. All right.

General BEACH. I have a chart here. I have taken a Nike air defense missile battalion and I will show how we build the battalion up from scratch. And this will illustrate the requirement for personnel.

I hope this chart doesn't scare you, sir.

On the bottom of the chart are weeks. They extend from zero to 80 weeks. The vertical axis is people, from zero to over 500.

This block here represents administrative time.

The right slant bar is basic training, and that is 8 weeks that everyone in the Army gets.

The horizontal bar area is the troop-trained specialist that I was talking about.

The black area is school training.

I will explain the vertical bar area later, which is package training.

The horizontal bar area is unit training.

Now, for the longest lead time individual, from the time he enters the Army—he will be going to school before he joins the unit for some 60 weeks.

The first 8 weeks he gets his basic training. Then, as I said, the fire-control maintenanceman was the most difficult skill. He starts that training. And that continues all the way through this black line.

Then there is an electronic materiel trained man. They come in 10 weeks later. Followed by a month or so later by officers and mechanical trained men. All of this black area—these are so programed they all graduate at the same time.

Back here, in this area, we have operators who get their basic training. It is the same training as given here. They are assigned to the first guided missile brigade, at Fort Bliss. They complete this training in time to join—enter this vertical area, which is package training. There are 139 individuals in each battalion, in this horizontal bar area.

They fire several missiles. They draw their equipment and actually fire the missiles at Red Canyon range, at White Sands.

While this is going on, there is another large group of fillers receiving their 8 weeks' basic training.

At the completion of that, they go to an actual site and receive training under the control of the cadre. There is another unit there that they are satellited on, and they get troop training.

In this period these people that have been in school for over a year get a short period of leave and travel to report to their operational site, around Washington or wherever they are going, and the entire unit is married up. It receives 7 weeks of unit training, that is, crew-type training, really, so that after 7 weeks, the entire unit is considered operational.

Then this training is continued for 6 more weeks, to give the unit more flexibility, so that 1 man can do more than 1 job. Eighty weeks after the time this first individual went in we consider the unit is completely operational.

Of course, from then on the training continues as refresher training.

Mr. HESS. How soon after the 80 weeks do they start dropping out?

General BEACH. Probably some already dropped out before you get here, for illnesses or various reasons.

Mr. HESS. No; I am talking about enlistments expiring.

General BEACH. The people that are in here [indicating] are all regular enlisted people, in this black area. These others are inductees.

Mr. COURTNEY. We are talking about the 3-year hitch.

General BEACH. Now, with a 24-month term of service here—well, they might have between a year and a year and a half to do before their term of service is up.

Mr. KITCHIN. Provided all of them start immediately.

General BEACH. Well, that is true, but they are brought in as a group and then the gradual attrition puts in enough additional people so they don't all leave at the same time.

Now, this black line here—these are the key people. This is the heart of your battalion. In this group are all the skills that involve the Nike on that handout.

This group here, encircled in the horizontal bar, is the unit training. And the skills in this group are not nearly as high as the ones in here.

Mr. COURTNEY. In numbers, what is represented there? What is that?

General RICH. 139, Mr. Courtney.

General BEACH. This is the 139 key personnel in the battalion.

Mr. COURTNEY. In battalions.

General BEACH. Called the package.

After they have been on site a year, about 180, this complete group plus some of these people, are returned to the Air Defense Center and go through another service practice.

Mr. HÉBERT. General, let me get something straightened out in my mind here.

Let's take John Doe.

General BEACH. Yes, sir.

Mr. HÉBERT. Who wants to enlist in the Army. He is deliberate about what he wants to do. He wants to become an electronics man. He knows if he enlists in the Army, the Army will train him.

General BEACH. That is right.

Mr. HÉBERT. If he is qualified.

General BEACH. That is right.

Mr. HÉBERT. And then he has every intent of getting out of the Army at the end of his obligated service and go into industry, backed by the training and education which the Army has given him.

Now, I am trying to reduce it to see if the picture is as dark as it really seems when you get down to actual numbers and not percentages.

John Doe enlists in the Army for a 3-year hitch. When does he become the top expert in electronics—what is your longest training, is it 80 weeks, I think you said?

Mr. HESS. 47.

Mr. HÉBERT. I mean the whole——

General BEACH. 47 weeks for a Nike-Hercules fire-control operator.

Mr. HÉBERT. You consider that the top training.

General BEACH. In these examples.

Mr. HÉBERT. All right. In 47 weeks he is qualified.

General BEACH. That is right.

Mr. HÉBERT. And he has to serve 2 years more.

General BEACH. Two years more.

Mr. HÉBERT. So he pays 2 for 1 for that education.

General BEACH. Yes, sir.

Mr. HÉBERT. Is that so bad when you take the Military Academy and you get 4 for 4? He gets a 4-year education and he only serves 4 years. He only matches it in equal numbers, and the other man matches it 2 for 1.

General RICH. The Military Academy is 3 years now, sir.

Mr. HÉBERT. They are going to the 4 years.

General RICH. Yes, sir.

Mr. HÉBERT. It has been 3 heretofore.

General RICH. It has been 3, and we are phasing into 4 now.

Mr. HÉBERT. That is right. And in the Air Force it will be 5.

The man is giving you 1 for 1, whereas this other individual is giving you 2 for 1.

General BEACH. In individual cases, you are absolutely right.

Mr. HÉBERT. In individual cases.

General BEACH. Excepting the amount of attrition is a little different.

Mr. HÉBERT. That is what I want to ask you.

Now, you have, say, 24 batteries—you have 24 men involved.

General BEACH. In that one particular example.

Mr. HÉBERT. In that one example.

General BEACH. That is the tactical requirement.

Mr. HÉBERT. Now, for a cure to it, a cure to this attrition—first, what are you backing up, on that 78 percent, say, nonreenlistment in numbers? How many men have you going behind these 24 men you have there?

General BEACH. We have replacements for all those that we expect to lose.

Mr. HÉBERT. You are backing them up.

General BEACH. We are backing them up; yes, sir.

Mr. HÉBERT. So, in reality, you are not weakening your potential.

General BEACH. No, sir; but we have to maintain a high school load.

Mr. HÉBERT. And a more expensive schooling——

General BEACH. More people in training and more instructors.

And the units never reach quite as high a peak of efficiency as if they are made up of a large number of people that have been in the unit for a considerable length of time.

Mr. HÉBERT. I think that was proven by an exercise that the Navy had on a submarine, where they took a highly proficient crew—I mean of these people—and I think the accident rate was less or something. But it proved out what you say there, in this particular exercise.

Now, in dollars and cents, and not percentages, how much of a dollar difference is there in holding these people in the service, instead of losing them to industry? Is the variance very wide?

In other words, take round figures: a man gets $100 with the Army. Added to that, he has the quarters and all the fringe benefits. He has his retirement, without putting a nickel up, and all that sort of thing.

Now, if you lose him to industry—supposing he gets $200 in industry, but he loses these fringe benefits in here, do I make myself clear on that?

General BEACH. Right.

Mr. HÉBERT. Now, how wide is that difference at present? Is it very wide?

General BEACH. Well, I would say it is pretty wide, as evidenced by the reenlistment rate, which right now—the last year for those who were eligible to reenlist, that is the ones that were discharged from October 1956 to November 1957, 25 percent of them enlisted.

Mr. HÉBERT. Only 25 percent?

General BEACH. That is correct.

Mr. HÈBERT. Now, without knowing the final details of the pay bill—I don't know whether you are even familiar with it or not, I mean the details.

General BEACH. I am familiar with it generally.

Mr. HÉBERT. Especially—I am getting down below the top, where you are not so familiar. Let me fill in. The colonels-up is very interesting.

I will give you this as just an example.

We just reported the bill out this morning, as to what you will have. You will have the creation of two extra enlisted grades, going up to E–9, I think it is—adding E–8 and E–9. And you will have a system of proficiency pay for the enlisted man in that bill.

And incidentally, Mr. Cordiner had none of this in his report at all. This was sold as a proficiency bill, with no proficiency provisions.

This is the committee bill. Under this system Joe Doe can go in as an E–1, which is your lowest one. He will have a military rank of E–1. He can go in as an E–1, which is the lowest pay, I think, after 2 years, at $105.

General BEACH. Yes, sir.

Mr. HÉBERT. But he can either be advanced up 2 or 3 grades for pay purposes, either under this system, which would give him, say, $100 more, or else the Secretary can elect under a proficiency system of 1, 2, and 3, starting at $50 per month more, $100 a month more, and $150 a month more.

Now, do you think that will help solve this problem?

General BEACH. It will certainly go a long way toward it, I am sure.

Mr. HÉBERT. We are talking about $100 now. Because here is $150 proficiency pay the individual can get in addition to what his military rank is.

Now, in dollars, is that a sufficient amount, in general? I mean we can't be specific.

General BEACH. All I can say is my opinion, offhand.

Mr. HÉBERT. That is right.

General BEACH. I would say that is certainly a fine start on the program, and it probably is a pretty good——

Mr. HÉBERT. You think that is a realistic approach to it?

General BEACH. A realistic approach.

Mr. HESS. Does that apply to every grade?

Mr. HÉBERT. Yes. The way the bill is coming out, the Secretary—you have as many combinations as you have poker hands.

Mr. HÉBERT. It is within—it is so flexible that they can treat with the individual categories, and the Secretary decides what the proficiency skills are.

That is all. I just wanted to find out if we are in the right course.

Mr. KITCHIN. Of the 75 percent that you say are not reenlisting, do you have any statistics as to whether or not pay is the major—or if it is the major cause, and what percentage of them do not stay or reenlist because of the pay schedule?

General RICH. I can give you an answer, Mr. Kitchin, in this manner, in that our surveys recently developed that the pay was the major reason in the area that General Beach is discussing.

Mr. KITCHIN. Yes.

General RICH. Now, when you get into the higher grades, the pay was not necessarily the major reason. It was housing or assignment——

Mr. KITCHIN. But in this particular category we are speaking of, pay was the basis?

General RICH. In that area, which was the man who you just brought into the service and who you have made into a highly trained specialist, the rate of pay for him outside of the service was so great that that was the major reason why he was leaving.

Mr. KITCHIN. So in answer to the chairman's question, this $100 differential, then, may have some effect on that group.

General RICH. It certainly should.

General BEACH. If I could summarize, just briefly.

Mr. HÉBERT. Yes, sir.

General BEACH. In the area enclosed by the black line on that chart there are three factors. First we select the man that gets that long schooling. He is selected on the basis of his general education and background, his aptitude as he demonstrates it in tests, and his general military fitness. Then once he has been selected, he has this long period of schooling, depending on what type of course he is going into.

As the individual is trained, before we have an operational unit, we have to put all these trained individuals together and have them operate as a team so that they will be able to function as a team.

At the end of that period, when we marry up all the other people—the fillers and so on—we end up with an operational unit.

The key part—when we lose more of these key-trained people, that is, the more we lose the greater our problem is in maintaining the efficiency of those units.

Mr. KITCHIN. Can you say if it is probable that in time that 80 weeks will be cut down with experience and proficiency of training personnel and have a shorter period of training to get an operational unit.

General BEACH. Well, it would vary some with the type of missile system. This is based on the Nike-Hercules training that we are doing right now on a new unit. Once a unit is organized and you have a background of experience, you just feed into the unit individuals to replace those that go out, and you do not go through this long process.

Mr. KITCHIN. So within a period of time you will have operational say all of the Nike units you will need?

General BEACH. Right.

Mr. KITCHIN. And then you will just put in these fillers.

General BEACH. You will still have to run these schools that are outlined by that black line, to replace people that we lose.

Mr. KITCHIN. And the 62 weeks, or approximately 56 weeks there that you have, you think that is cut down in as small a package as you can get it?

General BEACH. That probably is, but the unit will remain operational all the time because we will just feed individuals in.

Of course, we think that your bill that you put out is going to help a great deal in solving this problem.

Mr. HÉBERT. I am sure you won't be happy when you read it. General Hinrichs.

Mr. COURTNEY. General Hinrichs, the Acting Chief of Ordnance.

STATEMENT OF MAJ. GEN. J. H. HINRICHS, ACTING CHIEF OF ORDNANCE, DEPARTMENT OF THE ARMY

General HINRICHS. Mr. Chairman, it is a privilege for me to appear before you as a proponent of the Army arsenal system, because I feel strongly that it is an essential—a vital—part of our national defense system. I want to give you the current context against which I believe any discussion of the arsenals must be taken in order to insure proper perspective.

The job of the Chief of Ordnance, in its simplest terms, is to design, procure, supply, and service Ordnance materiel—such as guns, rockets, missiles, and ammunition for firepower; and tanks for mobility. These are lethal weapons, not commercial items.

Much of this job is accomplished through the cooperative efforts of the Ordnance-industry-science team. Each member of that team has an active and positive part to play. The Ordnance Corps must develop and maintain the managerial, scientific, engineering, and technical capabilities to direct this team effort in behalf of the Department of the Army, and fully utilize industry and science in the best interest of the Government. This capability is developed and maintained in the Ordnance arsenals.

The arsenals have five primary missions to perform for the Army and the Nation:

1. To evaluate and make recommendations concerning desired military characteristics, in terms of technical feasibility, complexity, and logistical implications.

2. To control at all times the quality and performance of materiel through the design, development, engineering, and production phases.

3. To provide capabilities to meet stated mobilization requirements, including furnishing to industry the leadership which keeps the art of military materiel production abreast of the military requirements and demands, and at the same time, consistent with scientific capabilities.

4. To serve as a repository of this munitions and armament knowledge and art during peacetime periods and periods of greatly reduced procurement activity.

5. To perform crash production to fill the inevitable gaps which appear in the production program at the outset of any national emergency, or to produce those urgently needed items or components which cannot be procured on a timely or economical basis from private industry.

To do these jobs, Ordnance people must be ahead of the state of the art in most instances and generally are, and never less than abreast of it.

Why is this so? With this competence in our people, and with the laboratory equipment and machines in our shops, the Chief of Ordnance can redeem his responsibility to supply American soldiers with quality materiel, and economically so. We can talk to our scientific and engineering and industrial counterparts—particularly our contractors—with certainty and understanding. With respect to method, to quality, to reliability, to direction, to ideas, we are able to say "yes" or "no" with assurance.

I might interject here to say that today I feel we have that capability.

If we cannot do that, we then let someone else make decisions for us and no longer have control of either quality or costs—we give someone else a blank check.

This is particularly true when we get into the very new, the "wild blue yonder" type of program, such as several we are in now in the missile field. Contractors, whether in research and development or production, are generally proud and competent people. They work better when it is for and with a competent organization staffed with competent people. (Incidentally, many have told me so.) Our arsenals are in that category.

I have made brief mention of the Ordnance-industry-science team and have given some emphasis to the role of the Ordnance Corps in that team effort. I should like to make it perfectly plain that the Ordnance arsenal system, far from being in competition with private industry, provides the leadership which enables that industry to make its finest contribution to the development and production of the materials of war essential to the firepower and mobility of our Armed Forces. Our responsibilities to American industry and science may be summarized somewhat as follows:

To know what Ordnance wants and when it is wanted, and what it does not want.

To be able to tell industry and science of those wants, basically through design concepts, drawings, and specifications.

To confirm progress in supplying those wants through progress reviews, tests or evaluations, and inspections, and very importantly, I might interject, to provide fair competitive opportunity, commensurate with capability and capacity, to participate in Ordnance programs.

To administer fairly and efficiently all contracts.

To make available technical guidance and assistance, particularly with informatioin that is available only to the military.

To emphasize the degree of industry and science participation in the Ordnance Corps program, as contrasted with the degree of utilization of our own resources, I should like to cite a few brief facts. The Ordnance Corps will expend, through its arsenal system, during fiscal year 1958 approximately $2 billion. Approximately $1.8 billion, or 90 percent, of that amount will be expended with private industry. I believe these figures speak for themselves and dramatically answer the question "Do the arsenals compete with private industry?"

Currently, as you know well, there is a tremendous emphasis in the rocket, missile, and antimissile missile field. Redstone Arsenal is the pioneer in that field, and the Army Ballistic Missile Agency has done a magnificent job in picking up the Redstone missile and carrying it forward into the Jupiter and related efforts. The commanders of Redstone Arsenal and the Army Ballistic Missile Agency call on the knowledge and skills of the other arsenals for supporting work. In round dollar figures, this amounted to $150 million in fiscal year 1958, which is about 50 percent of the total arsenal inhouse workload. For instance, Picatinny Arsenal is the Army's center of knowledge in atomics and other special weapons applications. It works for both Redstone and ABMA, and in fiscal year 1958 at a $24 million level. Rock Island Arsenal will do about $9 million and Watertown Arsenal will do about $8 million in fiscal year 1958, both in areas utilizing military knowledge not found anywhere else in the country.

The flexibility of the arsenals with resulting capability to convert to the era of new and improved weapons is well illustrated at Watertown Arsenal. In 1952, 100 percent of the internal workload at Watertown Arsenal was devoted to heavy field artillery and antiaircraft artillery. Today nearly 60 percent of the total inhouse effort at Watertown is expended on guided missile and special weapons materiel.

Finally, and in summary, I would like to quote from a recent statement of Secretary Brucker:

> The Army must have internal resources of dedicated, talented, and experienced people who can determine what the Army wants, state how it must perform to meet the Army's needs, and measure the performance of the completed article to evaluate its acceptability.
>
> The existence of the armywide arsenal system, wisely supported by Congress over the Army's long history, is another significant aid to our effective use of the public money. Our arsenals are far from manufacturing plants. They are pilot facilities where teams of experts work out production systems and check out manufacturing processes necessary to produce these many complex weapons systems. Our arsenals can closely predict what manufacturing costs ought to be and provide a valuable check on our contractors' bids.

Mr. HÉBERT. Thank you very much, General.

General HINRICHS. Yes, sir. Are there any questions that I can answer?

Mr. COURTNEY. General, I would take it that the matter of personnel, in filling the place you have, has been covered by the other witnesses?

General HINRICHS. Generally so, sir.

Mr. COURTNEY. The importance of the arsenal system you have just described of course would be largely dependent upon the personnel that you are able to attract and maintain?

General HINRICHS. That is correct.

Mr. Courtney and Mr. Chairman, I have a few specifics to the ordnance problem in the arsenals which, if it would please you, I would be glad to turn over to counsel.

Mr. HÉBERT. We would appreciate it.

General HINRICHS. Such things as have been outlined briefly by my predecessors here in the way of advertising, recruiting and similar pamphlets, and the programs which we have for personnel management within Ordnance, which come within the general line, both military and civilian, already outlined.

Mr. HÉBERT. I appreciate the position of Ordnance, in connection with the testimony in the education and scientific field, that you

are dependent upon the success of these previous programs described in order to staff your own arsenals.

General HINRICHS. Yes, sir. To a certain extent. However, we are the people who carry those programs out, sir—being the immediate contact—we have a very vital interest in being a very heavy participant in the programs that have been outlined.

Mr. HESS. You are consulted, aren't you, in the arrangement of those programs.

General HINRICHS. Oh, yes, sir. And I might add that we are not held back in going out and getting people, and trying to keep them.

Mr. HÉBERT. You couldn't have some of the most important components of this team you described if these other programs were not successful.

General HINRICHS. That is right.

As a matter of fact, in General Beach's testimony, in the latter part of that handout sheet he gave you, are people who are trained by Ordnance in the missile field, and in the support fields.

Mr. KITCHIN. Mr. Chairman, I would like to ask one general question. Maybe it has been answered and I have missed it. Does the Army—and I will direct this to any one of you or all of you.

Does the Army find a lack of scientific personnel available at this stage of the game?

I am not talking about, now, the adequacy of various programs, but the material scientist and engineer in being as he graduates from college. Do you find a lack or not?

General HINRICHS. I can answer specifically in my own area, sir.

In round figures, we are short roughly 200 of the scientific type of personnel, out of a total requirement in the area of 1,800.

Mr. KITCHIN. Yes.

And I understood that there was another statement of 608 vacancies in one field.

But my question is: Is that a lack of a program such as a pay scale, or a recruitment program, or is it a lack of the available personnel from which to draw if you had all the workable programs that you wanted within the Army?

General RICH. So far as the military personnel are concerned, armywide, there is not a lack of that individual, if we could get him and keep him.

Mr. WILLEY. As far as the civilians are concerned, I think the skills are available in the United States, but the long recruitment lag is because we are unable to compete with industry in getting the skills.

Mr. KITCHIN. And that is the answer I wanted. There is not, in your opinion, a lack of that type of personnel available.

Mr. WILLEY. No, sir.

Mr. KITCHIN. It is a lack of programs and the facilities to facilitate those programs.

Mr. WILLEY. Right.

Mr. HÉBERT. There is no lack of an adequate pool of individuals.

General RICH. The pool is there, but we can't get them out.

Mr. HÉBERT. You can't get the fish out, except with a gold hook.

Mr. KITCHIN. I base that on the hue and cry now that our education associations are putting up to the people, that there is a dire shortage of engineering and scientific personnel being graduated from our colleges.

Mr. HÉBERT. And let us pay teachers more.

Mr. KITCHIN. Yes, sir.

Mr. HÉBERT. Any further questions?

Mr. HESS. No questions.

Mr. HÉBERT. Thank you gentlemen, very much.

You have been most helpful. And I wish to compliment the Army on its presentation. I think the information given today will be most helpful to us. Thank you.

General RICH. Thank you, sir.

Mr. WILLEY. Thank you.

General BEACH. Thank you.

General CONWAY. Thank you.

General HINRICHS. Thank you.

Mr. HÉBERT. We will recess until Thursday afternoon, when we will take the Department of Air Force.

(At 4 p. m., a recess was taken, to reconvene on Thursday, March 20, 1958.)

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SPECIAL COMMITTEE NO. 6,
Washington, D. C., Thursday, March 20, 1958.

The subcommittee met, pursuant to adjournment, at 2 p. m., the Hon. F. Edward Hébert, chairman, presiding, with Mr. Hardy, Mr. Kitchin, Mr. Hess, and Mr. Wilson.

Mr. HÉBERT. The committee will be in order.

Mr. COURTNEY. Gen. Richard H. Carmichael, Director of Personnel Procurement and Training for the Air Force, and Mr. John Watts, who is the Director of Civilian Personnel for the Department of the Air Force. Neither witness has been sworn.

Mr. HÉBERT. Will you gentlemen rise, please, and take the oath?

You and each of you do solemnly swear that the testimony you will give before the subcommittee in the matters now under consideration will be the truth, the whole truth, and nothing but the truth, so help you God?

General CARMICHAEL. I so swear.

Mr. WATTS. I do.

Mr. COURTNEY. Mr. Chairman, General Carmichael has a prepared statement with some supporting data. General, will you proceed in your own way?

STATEMENT OF MAJ. GEN. RICHARD H. CARMICHAEL, DIRECTOR OF PERSONNEL PROCUREMENT AND TRAINING, DEPARTMENT OF THE AIR FORCE

General CARMICHAEL. I have a prepared statement that is somewhat less than the statement that I have given to the subcommittee. I think this will run somewhere around 12 minutes.

Mr. HÉBERT. Well, do you want your original statement, General, to be inserted as having been read and then give the summation that you have, or would you prefer to rest on the short statement?

General CARMICHAEL. I would prefer that; yes, sir. The original statement which we submitted is for the record.

Mr. HÉBERT. Your original statement will appear in the record as having been read, and you will now summarize.

General CARMICHAEL. All right, sir.

My presentation will cover the USAF officer education programs, particularly in science, engineering, and related fields, and comment on the adequacy of these programs to meet the needs of the Air Force.

Mr. Watts, Director of Civilian Personnel for the Air Force, will make a separate presentation dealing with these same problems as they relate to our civilian personnel.

I would like to start first with requirements.

The Air Force education program for officers is established to meet the following major objectives:

(1) Provide qualified officers for duty in those occupational fields in which undergraduate or graduate college level education is a mandatory requirement, for example: Weather officer, mathematician, electronics engineer, nuclear officer, guidance systems officer.

(2) Provide a gradual improvement in the educational level of officers assigned to duty in those specialties in which a graduate degree is a desirable but not a current mandatory requirement.

(3) Provide an opportunity for career officers to raise their educational level.

Skills required in occupational fields have a bearing on the educational needs of Air Force officers. Consequently, qualitative educational requirements have been related to the officer occupational skills needed to accomplish the Air Force mission. These requirements have been reflected as a percentage figure of officers authorized in each Air Force occupational specialty in order to provide a stable base for computing and operating annual programs.

Some of the more important factors influencing the need for personnel with scientific, engineering, and technical backgrounds are as follows:

(1) The missile and manned-space vehicle era has increased the requirement for such personnel. Even before the missile era, complex weapons, increased speed, range, and firepower boosted the Air Force need for technicians. Preliminary planning of a comparative form (manned-aircraft units versus comparable missile-equipped units) indicates an increased requirement for technical and scientific personnel.

(2) Missile units shall be dispersed. Further, cold war conditions will require a missile force at readiness around the clock, thus multiplying the number of specialists required.

(3) The future Air Force will require a hard core of professionally qualified scientific, engineering and management personnel for work in the research and development planning and management phases before weapons and equipment are given to the technical and scientific supervisors in the field.

(4) Matching of new weapons and trained manpower will also require professionally competent administrators and educational programs.

(5) An additional requirement will be generated in the support occupational fields. There must be an organic capability to maintain the advanced aircraft, missiles, and manned-space vehicles. The

maintenance and supply fields will also require technically qualified people.

(6) Some areas in the space science of astronautics where additional trained personnel must be provided are: Ballistics engineering, guidance systems, digital and analogue computation, space physics, meteorite studies, space navigation, cosmic rays, advanced meteorology, and orbital mathematics.

A 10-year plan consolidating Air Force college-type educational requirements was developed in 1955. This plan is the basis for the annual Air Force Institute of Technology professional education program. This plan is periodically reviewed to reflect changes in officer skill requirements. Inclosure 1 includes a copy of the Consolidated Educational Requirements (10-year plan) and the Air Force Institute of Technology professional education program—fiscal year 1959. This inclosure indicates how long-range requirements are translated, with modifications, into annual educational programs within current manpower and fund limitations.

I think first I should talk about procurement sources before going any further.

Air Force officers come from six sources:

(1) The Service Academies—currently West Point and Annapolis—provide approximately 340 officers per year who are presently committed to a minimum of 3 years' active duty. Officers entering flying training agree to remain on active duty with the Air Force for 4 years following completion of flying training. The Air Force Academy will produce its first graduates in 1959 with a class numbering approximately 200. Thereafter, a yearly increase in output is programed to provide approximately 500 officers annually beginning in 1963. The programs of studies at the Service Academies are not designed to prepare the cadets for graduate study in particular science and engineering fields. Many graduate education programs require prerequisite courses which Service Academy graduates do not have. Only those cadets who have demonstrated an aptitude for work in science and engineering by the excellence of their achievements in these fields in the Academies can be matriculated in many graduate science and engineering courses. For example, the Air Force guided-missiles course at the University of Michigan is specialized to a degree that only the top 10 percent of current Service Academy graduates can be matriculated. The same holds true of other graduate courses in the science and engineering fields.

(2) The Air Force ROTC program was the source for approximately 6,300 officers who entered active duty in fiscal year 1957. Of the 6,300 officers, 2,300 had bachelors' degrees in science or engineering; 1,400 of these officers were programed to enter flying training, and the other 900 entered active duty in a nonflying status. In addition, approximately 100 ROTC graduates are permitted to remain in school each year to complete the master's level requirements in science or engineering before entering Air Force duty. These officers are delayed in their entry to active duty to complete the masters' degree at no expense to the Air Force.

(3) OCS provides between 400 and 500 officers each year. These officers have varied educational backgrounds. Only about 2 percent hold the baccalaureate degree.

(4) The aviation-cadet program provided 1,583 officers in fiscal year 1957. The current academic requirement for entry into the aviation-cadet program is a high-school diploma for civilians, or high-school diploma or equivalent for airmen. Graduated cadets therefore have varied educational backgrounds. Approximately 6 percent of the 1957 aviation cadet enrollees held the baccalaureate degree. Another 44 percent of this group had 2 or more years of college.

(5) The voluntary recall system provided approximately 500 officers in 1957 in selected specialities.

(6) The direct commissions currently offered are limited to WAF, chaplains, lawyers, and medical officers.

I would like to speak now about Air Force officer educational levels in the scientific and engineering fields.

Statistics are attached as enclosures No. 2 and No. 3 showing Air Force officers with college degrees, by academic fields and levels.

To summarize these statistics the Air Force has 13,139 officers with engineering degrees (including 3,300 Military and Naval Academy graduates) : 12,099 at the bachelor's level, 1,008 at the master's level, and 32 at the doctor of philosophy level. Of 6,270 with degrees in science, 5,596 are at the bachelor's level, 600 at the master's level, and 74 at the doctor of philosophy level.

Now our programs in science and in engineering fields.

The United States Air Force Institute of Technology located at Wright-Patterson AFB, Ohio, conducts or administers the principal programs established by the Air Force to provide officers qualified in science, engineering, management, and other professional fields. These educational programs are conducted by the Institute through its own School of Engineering, School of Business, Installations Engineering School, and advanced logistics research project located at Wright-Patterson AFB—these courses are shown on the left-hand side of the chart, or, a far larger program, by contract with various civilian universities and industries.

(1) The Institute's School of Engineering offers undergraduate and graduate education with emphasis on the latter. At the present time, special, applied type engineering courses designed to meet Air Force needs are offered in the aeronautical, electrical, nuclear, and air ordnance fields. The planned annual input into these courses which run from 12 to 24 months is 185 students. The School of Business conducts three graduate programs as follows: Engineering administration, industrial administration, and applied comptrollership. These courses run from 12 to 18 months with a planned annual input of 75. Each year, the Institute's Installations Engineering School offers a 9-month program for 50 officers, 4 short courses of 9 weeks duration for a total of 200 officers. The advanced logistics research project provides specialized graduate level education for 20 officers each year in the logistics field.

(2) The Institute's civilian institutions programs, on the right side of the chart, provide for a wide variety of undergraduate level and graduate level education with the major part of the program being devoted to science and engineering education. The courses normally run from 1 to 2 years. Of a planned fiscal year 1959 input of 1,302 officers in college courses, 945 or 72 percent will be entered in science or engineering fields.

(3) In addition to the regular college-type training, the Institute provides science and engineering training through its short course program. This program involves concentrated training in specialized subjects related to an officer's immediate duty assignment. The courses are established at civilian institutions and are of less than 20 weeks duration. They enable Air Force commands to provide for immediate and specific needs; for example, providing special mathematics or computer training for an Air Research and Development Command officer at a civilian university because he requires the knowledge and skills for a project he is working on. In fiscal year 1959, the Air Force is planning for 300 short course requests from the major air commands. It is estimated that 250 of these requests will be for science and engineering courses.

(4) In addition to short courses conducted by the Institute, the Air Command and Staff College of the Air University also conducts a number of short courses varying in length from 1 to 6 weeks. The purpose of these courses is to familiarize key personnel with the characteristics and problems associated with the employment of nuclear weapons, guided missiles, and operations beyond the earth's atmosphere.

(5) The Institute's civilian institutions program also includes on-the-job training with industry. In addition to management-type training in industrial planning and procurement, ths program includes training in reactor technology at the Oak Ridge School of Reactor Technology, training in guided missiles, piloted aircraft weapon systems and research and development administration. Officers are given training with major Air Force contractors working in these areas. This training is accomplished at no cost to the Government. The Air Force also offers training with industry in the wire communications field which is conducted by the various telephone companies and the Army Signal School. This is the only training-with-industry program involving tuition charges. In fiscal year 1959, a new course will be added in the field of astronautics. The officers will be assigned for on-the-job training with Air Force contractors working in this area; 102 officers will enter training with industry in fiscal year 1959.

(6) From fiscal year 1946 through January 1, 1958, the Institute has produced the following number of officers in science and engineering programs.

At the bachelor degree in engineering, 1,272; biophysical science, 153; meteorology, 180.

At the masters' level, 1,247 in engineering; 306 in biophysical science; 278 in meteorology.

At the Ph. D. only a handful, all 3 totaling 68.

All other nondegrees amounted to 1,429, with a total of 4,933 having been trained in science or industry at all 3 levels.

Further details regarding the number of graduates who have completed various Air Force Institute of Technology courses is included in enclosure No. 4. Tuition costs for a year of science or engineering education in civilian institutions average $1,015. Courses vary in cost from a low of $693 for civil engineering to a high of $2,110 in graduate geophysics. Total cost by fiscal year for college courses, training with industry and short courses, which includes nontechnical as well as science and engineering courses, is shown below.

College courses: fiscal year 1957, $1,397,122; fiscal year 1958, $1,304,270; fiscal year 1959, $1,399,735.

Training with industry: fiscal year 1957, $36,525; fiscal year 1958, $44,400; fiscal year 1959, $48,780.

Short courses: fiscal year 1957, $60,000; fiscal year 1958, $29,000; fiscal year 1959, $60,000.

Total: fiscal year 1957, $1,493,647; fiscal year 1958, $1,377,670; fiscal year 1959, $1,508,515.

Examples of the specific costs by course and schools utilized are reflected in enclosure No. 5.

Tuition assistance programs: Bootstrap.

In addition to the Air Force Institute of Technology program, there is an extensive, worldwide Air Force off-duty education program, known as Bootstrap. This program provides officers and airmen an opportunity, with tuition assistance from the Air Force, to complete high school and college level education during off-duty hours. When a student comes within 6 months of a college degree, he may apply to attend college on a full-time basis to complete college degree requirements. The Bootstrap program has an average annual participation of nearly 6,000 officer students studying on off-duty time. Of this group 4,991 are currently enrolled in undergraduate courses and 951 are enrolled in graduate courses. There are 516 officers currently enrolled in scientific, engineering, and foreign language programs; 449 at the undergraduate level and 67 at the graduate level.

During fiscal years 1952 to 1957, 3,600 officers earned degrees on their off-duty time; 3,024 undergraduate degrees and 576 graduate degrees. Of these earned degrees 312 were in science, engineering, and foreign language fields; 272 undergraduate degrees and 40 graduate degrees.

United States Armed Forces Institute (USAFI): The Department of Defense provides correspondence courses in academic subjects and testing services for all the Armed Forces through USAFI. Approximately 200 high school, college, and vocational type courses are offered. In addition, accredited colleges and universities provide 6,400 correspondence courses in cooperation with USAFI.

This provides Air Force personnel an opportunity for educational improvement in various academic fields anywhere that mail can reach him. Activity in 1957 included the participation of 68,851 Air Force personnel in USAFI correspondence courses; 99,175 Air Force personnel participating in group study courses using USAFI material; 3,300 tests administered for obtaining elementary-school certificates, and 14,803 tests administered for high-school diplomas.

Extension Course Institute, USAF: The Air University operates a correspondence course service through the Air Force Extension Course Institute located at Gunter Air Force Base, Ala. This service provides an opportunity for Air Force personnel to study by correspondence. The courses fall into two categories: general military education and specialized courses, mostly of a technical nature. Over 200,000 individuals are currently enrolled.

Obligated service: With the exception of some meteorology graduates, officers completing Air Force Institute of Technology courses that I will refer back to are required to remain in the Air Force for a minimum of 3 years following termination of their educational programs. Normally, only career officers are entered into the Institute

program. Officers participating in bootstrap education program are required to remain on active duty for a period of 2 years following termination of the course of education they enter. Officers attending other types of training incur a service obligation proportionate to the course length.

Of vital importance to us is the retention of the people we have trained.

While ROTC sources provide college-trained personnel in large numbers, such personnel do not remain in service beyond the initial 3-year tour in sufficient numbers. This leaves a gap between the new officer input and senior level group. Thus the principal source of junior scientists and technicians is not career-minded. For most of these officers the incentives of a career with civilian industry outweigh those of a military career. Many ROTC officers are committed to join industry immediately upon completion of their 3-year Air Force tour.

For example: (1) A July 1956 survey of AFROTC graduates on active duty, by school, indicates that none of the graduates of the following schools intend to stay in the Air Force: California Institute of Technology, Stevens Institute of Technology, and Lowell Technical Institute. (2) A May 1956 survey of career plans by academic major of noncareer officers indicated the percentage by field of those planning to stay in:

	Percent
Engineering	5.4
Biological science	21.5
Physical science	11.5
Social science	15.1

In 1953, an interview survey was started at the Personnel and Training Research Center at Lackland Air Force Base. A total of 1,238 nonrated officers passed through Lackland during that fiscal year. We have actual experience which shows that of the 1,238, today there are only 175 left on active duty. And of those, only 5 in the engineering fields, for a total of only 3 percent remaining. And only 12 in the biological physical sciences, for a total of 18 percent.

Of all college majors, engineering, biological physical scientists, social science and liberal arts, business, education, agriculture, and other, the overall percentage remaining with the Air Force today is only 12 percent.

While it is an oversimplification to say that "The best get out of the service," there appears to be a direct relation between graduate education and attrition. Approximately 75 percent of the graduates of scientific and engineering programs are young company-grade officers. To the skilled officer with a graduate degree, the factors of higher salaries and civilian job and career opportunities become extremely attractive. In addition to the high attrition rate among younger ROTC officers, a significant number of graduate level educated officers leave the service soon after completing their obligated service.

Now, briefly, I would like to address myself to a few questions. First, does available manpower meet Air Force requirements for technically trained officers?

The answer is that due to the low retention, there is a quantitative deficiency in the manpower program in terms of total number of personnel required to man the currently programed force. This situation

has been brought about by the recent reduction-in-force actions occasioned by the new force ceilings.

In addition, the number of officers which the Air Force may have and grade limitations applied to these officers are not necessarily based on Air Force requirements. The total number authorized can be procured on a quantitative basis. There is a much larger problem in the qualitative manning of the Air Force. Due to the low retention rate of AFROTC groups, which include the largest number of younger officers qualified in science and engineering, the Air Force has a shortage in these areas in the 4 to 14 years of service group. Therefore, although there are enough individuals entering the Air Force with the educational background and potential required, far too few are remaining beyond their obligated tour. Hence, there is a gap between the junior officers and the senior officers in the specialty areas under consideration. The Air Force presently accept approximately 98 percent of all officers who request career status in an effort to meet quantitative objectives.

However, insufficient numbers of officers well qualified in the science and engineering fields seek career status. In the future, the capability of the Air Force to meet its officer needs is contingent upon the availability of adequate pay scales and other benefits to make service attractive.

Are current educational programs adequate for foreseeable needs? If not, what additional programs are planned to meet future requirements?

The Air Force does not propose to meet all requirements for educationally qualified officers through service-subsidized education programs. Major officer procurement programs have been and must continue to be geared to obtaining officers who have already completed baccalaureate level educational programs. With mandatory requirements filled in this manner, Air Force programs can be devoted primarily to graduate level training. It is becoming clear that current education programs, however, are not adequate to meet foreseeable Air Force needs in most technical areas due to the low retention of technically trained personnel and current qualitative shortages. Advancing technology will increase the demand for highly trained officers in the engineering and scientific areas both from a technical and a managerial viewpoint. Even though new developments in weapons systems, air and space vehicles, data processing, and navigation, to cite a few, may be derived from the traditional disciplines, there are new areas of knowledge which will have a direct bearing on Air Force activities. For instance, the current statement of objectives of the department of aeronautical engineering of MIT reads that aeronautical engineering is "a field that is going ahead so rapidly that formal written material lags well behind existing knowledge." The difficulty of identifying projected requirements stemming from foreseeable weapons limits programing of education to meet such future needs.

When an educational requirement is identified, it takes several years before the graduate personnel are available as an Air Force resource. If it is determined today that an additional significant number of Air Force officers are needed with the doctorate degree in nuclear physics, it will be some time in 1961 before such officers are trained and back on the job for which the requirement exists. Education programs are

constantly modified as new requirements are identified. In addition, recurring examinations are made of the entire education effort. In November 1956 a board of 12 general officers, headed by Gen. E. W. Rawlings, critically examined the Air Force officer educational system as to its adequacy, organization, objectives, and methods of operation to properly fulfill USAF requirements.

This Rawlings board was the follow-on 6 years later of the Gen. Muir Fairchild board that gave the first comprehensive review of our educational system back in 1950.

The Air Force has recently appointed a board of general officers under the leadership of Gen. Dean C. Strother, commander of the Air University, to study the problem of the effects of new weapon systems on Air Force educational requirements and to recommend necessary changes in the Air Forces' education programs.

If programs are inadequate, what are limitations involved?

Low retention of officers qualified in the science and engineering fields makes present programs inadequate to meet current and foreseeable needs. Losses of career officers in these fields are somewhat higher than in less technical fields. Most serious is the very low retention rate of science and engineer graduates from the ROTC source which constitutes the major portion of officer procurement. Inability to retain these officers deprives the Air Force of a major resource qualified for entry into advanced science and engineering education. Enclosure No. 6 to this statement indicates how this affects the scientific and engineer resource. Austere manpower and budgetary ceilings impose limitations on Air Force education programs. Such programs must compete with pressing operational and developmental requirements. The career officers best qualified to enter graduate educational programs are often also most critically needed in current operations. Although education funds are a relatively small part of the total budget, pressing current needs dictate that education programs be held below optimum levels. While the Air Force is acutely aware of long-term value of an optimum education program, the need to maintain an adequate defense posture while concurrently integrating new weapons systems into the Air Force makes undesirable compromises unavoidable.

What is being done to improve or increase the supply and quality of specialists?

In personnel procurement the following actions are being taken: (1) Authority has been requested to procure college graduates from other than ROTC schools. Individuals obtained from this source would be given commissions after completing an abbreviated officer candidate school program. (2) A means to subsidize the education of career-minded airmen who would be commissioned upon the completion of their academic programs is currently being investigated. In fact, the Air Force is seriously studying some sort of a subsidized program, as the Navy has through its Holloway plan.

(3) Beginning with the enrollment of AFROTC juniors in the fall of 1958, cadet selection for the flying training categories of ROTC will be oriented where possible to individuals pursuing fields of study most valuable to the Air Force. However, motivation for flying and an Air Force career will continue to be prime factors in the selection of this group of cadets. In addition, 85 percent of the

cadet enrollments for nonflying duty assignment will be restricted to specified fields of study required by the Air Force. The remaining 15 percent of the nonflying enrollment will be from other useful fields of study.

To improve retention the Air Force is: (1) Supporting efforts to obtain a readjustment and modernization of our compensation system which will improve the stability and efficiency of the force and stem the great cost of training new personnel; (2) devoting increasing funds to the construction of on-base housing and personnel facilities; (3) considering the advisability of permitting noncareer officers to apply for service-sponsored graduate-level education programs. If accepted for the programs officers would be required to sign career service commitments prior to entry into training. In general, we are trying to make Air Force life better.

To improve educational programs, the Air Force is: (1) Conducting full time educational programs with emphasis on the science and engineering fields; (2) the Air Force has requested $7.4 million in its fiscal year 1959 construction program to provide badly needed classrooms and laboratories for the Institute's School of Engineering; (3) conducting the Operation Bootstrap program; (4) contributing to the costs of offduty education courses which individuals pursue on their own initiative; (5) authorizing the detail of officers to the National Advisory Committee for Aeronautics. Individuals concerned work as assistants on NACA research projects and complete related formal educational studies.

The Air Force has recently increased the obligated tours of pilots and navigators. There are a number of these pilots and navigators who have educational backgrounds in the fields of physical science and engineering. It is contemplated that some of these officers, after completing a tour in the cockpit, will be given additional education in selected specialty areas.

An Air Force officer career management plan is presently being developed which would provide for developing and utilizing both the technically competent and the broadly qualified officers that are, or will be, needed. Specifically included in the proposed plan are policies to: (1) Assign all officers in a specialized area of related skills during the early years of their careers, based on their best qualifications and Air Force needs. This is considered necessary to develop the technical competence required and to provide a sound foundation for further career development and progression. It also will enable the Air Force to best utilize those officers who do not elect the Air Force as a career. (2) Effect planned and progressive broadening commensurate with increases in qualifications and grade. (3) Continue specialization in highly technical skills where required, such as in the scientific, engineering, and logistics areas. (4) Assure that rated officers are initially assigned in their rated specialty, in order to develop the combat readiness ability required. Upon reaching the grade of captain, rated officers would be rotated into support areas. This would be based on their education, previous experience, training, desires, aptitudes, and other qualification factors, and the needs of the Air Force existing at the time. For example, a pilot who has been educated as an engineer would, after initial specialization as a pilot, be assigned to an engineering support area. He

would then be utilized and further broadened in the engineering area commensurate with his increased qualifications and grade. Subsequently, he could then be returned to flying or command positions, as needed, based upon Air Force requirements.

The following actions have been taken to improve officer asignments and utilization controls: (1) Air Force specialty codes for officers identity education, training, experience, and skill requirements for a related grouping of tasks. Through established controls, each officer is classified in one or more specialties. Generally speaking, he will be assigned for duty to that specialty which has highest priority and/or makes the highest and best use of his proven qualifications. (2) With the exception of officers scheduled for flying training, Headquarters USAF directs initial assignments of newly commissioned officers with scientific, engineering, and technical backgrounds after reviewing their total qualifications. Such personnel are assigned to research and development or other technical specialties whenever possible. (3) At an appropriate time in each officer's career he is normally given opportunity for upgrade training in his specialty or for lateral training or experience in related specialties. This includes duties of training associated with aircrew specialties such as pilot or navigator. After 18 months commissioned duty an officer may apply and be considered for graduate or undergraduate education. Selected officers with the most meritorious records are entered in various scientific, engineering, technical, and other educational programs. At the time of entry they are earmarked for controlled assignments upon graduation in specialties related to the planned education. This special control by Headquarters USAF is maintained for 3 years and is designed to secure early use of the education and an appropriate return on the investment. (4) Assignments of all research and development officers are monitored on a name basis by Headquarters USAF in coordination with major air commands. Assignment limitations are imposed as necessary to insure effective utilization of technical skills and knowledge.

We have a few other problems. The limitations of the Nation's supply of scientists and engineers will affect the resource on which the Air Force will draw for its officers and graduate students. There are only predictions as to how successful the United States will be in improving the existing shortages in professional manpower; but the predictions generally express doubt as to the possibility of making a large-scale quantity improvement in the next 10 years. The unfortunate facts are: Too many young men fail to acquire even the elements of a basic education. The United States Department of Labor stated in a study entitled, "The Skilled Work Force of the United States" (1955), that roughly 50 percent of all men of military age are not high-school graduates. Further, many high-school graduates do not have the basic background for college training in the fields in which the Air Force is short. In January 1958, Dr. Charles A. Quattlebaum, of the Library of Congress, in an article which was entered in the Congressional Record, surveyed the various national resources and requirements for scientists and engineers. His article includes this comment:

> The current combined deficits of physical scientists and engineers are most frequently estimated to be from 45,000 to 65,000 persons. The average annual demand for physical scientists and engineers during the next 10 years is most

frequently estimated from 80,000 to 100,000 persons. The average annual number of persons estimated to receive first professional degrees in engineering and the physical sciences during the next 10 years is 63,000.

The effect of this situation on the Air Force is and will continue to be twofold: The resource of scientists and engineers will be at an austere level for the foreseeable future; and the Air Force will remain in active competition for the most skilled college graduates.

In conclusion, Air Force objectives and policies relating to officer education programs are considered generally sound and adequate.

The Air Force must strengthen and develop its science and engineering programs. Plans to construct adequate facilities for the Air Force Institute of Technology must move forward into the action stage.

The Air Force must devote the major part of its officer education program to meet identifiable requirements and must therefore rely on initial procurement sources, off-duty education and other supplementary programs to raise the general educational levels to desired goals. Supplementary manpower spaces and funds and necessary legislative authority provided as a part of a national program to increase education in science and engineering fields could assist in meeting Air Force and national requirements.

Current officer education programs, procurement sources, and specialist inventory are adequate to meet current overall quantitative requirements, but are inadequate to meet current and foreseeable qualitative requirements, particularly in the science and engineering fields.

This is due principally to low retention of officers qualified in science and engineering, limitations imposed by austere manpower and budgetary ceiling, are factors adversely affecting the attainment of desirable educational goals, particularly in the science and engineer fields. Retention could be improved with a modernized pay structure.

The six attachments include:

1. Consolidated educational requirements AF 10-year educational requirements and fiscal year 1959 institute educational program.
2. Status of AF officers by academic fields and levels of education.
3. Officer engineers and scientists by academic field and level of education.
4. Institute current program and production.
5. Representative tuition costs by course and college and universities utilized.
6. Officer science and engineering inventory by years of military service.

(The attachments are as follows:)

Consolidated educational requirements (10-year plan) by academic fields

	Graduate	Undergraduate	Total
I. Engineering and Sciences:			
A. Engineering	4,526	1,823	6,349
1. Administration	523		
2. Aeronautical:			
(a) Aerodynamics	18		
(b) Flight test	4		
(c) General	714	303	
(d) Guided missiles	14		
(e) Instrumentation	9		
(f) Propulsion	14		
3. Civil	44	8	

Consolidated educational requirements (10-year plan) by academic fields—Con.

	Graduate	Undergraduate	Total
I. Engineering and Sciences—Continued			
A. Engineering—Continued			
4. Electrical:			
(a) Communications	11		
(b) Electronic countermeasures	22		
(c) General	1,873	1,041	
(d) Servomechanisms	22		
5. Industrial	606	190	
6. Mechanical:			
(a) Air conditioning and refrigeration	22		
(b) General	279	281	
(c) Heat-power	22		
(d) Propulsion	44		
(e) Thermodynamics	22		
7. Nuclear	201		
8. Ordnance	44		
9. Physics	11		
10. Safety	7		
B. Science	284	48	332
1. Chemistry:			
(a) Biochemistry	5		
(b) General (emphasis on inorganic, synthesis, or analytical)	5		
(c) Nuclear	4		
2. Bioradiology	5		
3. Electronics	22		
4. Geography	9		
5. Mathematics:			
(a) Digital computation	13		
(b) Numerical analysis	2		
(c) Pure	8		
(d) Statistical	16		
6. Photogrammetry	18		
7. Photography (aerial-photo reconnaissance)	125	48	
8. Physics:			
(a) Acoustics	5		
(b) Atomic	6		
(c) Classical	4		
(d) Meteorological geophysics	9		
(e) Nuclear	20		
(f) Quantum	3		
9. Physiology	5		
II. Management and social sciences:			
A. Management	4,966	1,879	6,845
1. Business administration:			
(a) Accounting	187	295	
(b) Finance		13	
(c) Personnel		331	
(d) Management	4,320	998	
(e) Research and development	137		
(f) Statistics	33	38	
(g) Transportation	153	87	
2. Clothing technology	2		
3. Packaging technology		19	
4. Police administration		56	
5. Public administration	134		
6. Traffic control		42	
B. Social sciences	537	109	646
1. Anthropology	5		
2. Communicative arts	4	6	
3. Correctional administration	19	30	
4. Economics	33	20	
5. Education (major in safety)	7		
6. International relations	290		
7. Journalism	7	12	
8. Motion-picture arts and sciences	6		
9. Political science	83		
10. Psychology	12		
11. Public relations	18	36	
12. Sociology	53	5	
Grand total			14,172

AFIT professional program, fiscal year 1959

Major academic field	Level of education			
	Bachelor of science	Master of science	Doctor of philosophy	Total
Engineering:				
Architectural	1	0	0	1
Aeronautical	46	63	1	110
Civil	10	10	0	20
Electrical	157	91	1	249
Industrial	23	12	0	35
Mechanical	23	18	0	41
Metallurgical	0	1	0	1
Nuclear	5	27	1	33
Ordnance	0	19	0	19
Subtotal	265	241	3	509
Engineering management:				
Engineering administration	0	25	0	25
Research and development	0	16	0	16
Subtotal	0	41	0	41
Management and social sciences:				
Advanced logistics	0	20	0	20
Advanced management	0	97	0	97
Applied comptrollership	0	25	0	25
Business administration	3	0	0	3
Business administration with major as accountant	7	6	0	13
Business administration with major in management	15	11	0	26
Business administration with major in personnel	18	3	0	21
Business administration with major in statistics	3	2	0	5
Business administration with major in transportation	3	7	0	10
Clothing technology	0	1	0	1
Communications, public relations	1	2	0	3
Correctional administration	2	2	0	4
Criminology	4	2	0	6
Education	0	4	0	4
Industrial administration	0	25	0	25
International relations	6	8	0	14
Motion-picture science	2	0	0	2
Packaging technology	2	0	0	2
Photogrammetry (noncartographic)	0	2	0	2
Physiology	0	0	1	1
Political science	0	3	0	3
Psychology	0	1	1	2
Public administration	3	12	0	15
Safety engineering	0	2	0	2
Traffic control	2	0	0	2
Subtotal	71	235	2	308
Physical science:				
Aerial photo reconnaissance	6	8	0	14
Biophysics	0	0	1	1
Cartography	3	0	0	3
Chemistry	0	1	0	1
Electronic data processing	0	14	0	14
Geodesy	1	1	0	2
Mathematics	0	6	2	8
Meteorological geophysics	0	0	1	1
Microbiology	0	1	0	1
Nuclear chemistry	0	1	1	2
Nuclear physics	0	3	1	4
Physics	0	7	0	7
Subtotal	10	42	6	58
Additional requirements:				
Basic meteorology	250	0	0	250
Advance meteorology	0	50	0	50
Academy instructors [1]	0	53	28	81
Special research-instructor students (Ph. D.)	0	0	5	5
Subtotal	250	103	33	386
Other programs:				
Training-with-industry				102
Special short courses				428
General short courses				300
Subtotal				830
Grand total	596	652	44	2,132

[1] Includes 16 engineers, 16 biophysicists, 3 languages, 46 arts and social science.

Air Force officers,[1] by academic fields and levels, by component

Code	Major academic field / Classification description	Established DOS				Career Reserve				Regular				Grand total			
		B. S.	M. S.	Ph. D.	Total	B. S.	M. S.	Ph. D.	Total	B. S.	M. S.	Ph. D.	Total	B. S.	M. S.	Ph. D.	Total
01	Engineering, general	142	1	0	143	159	11	0	170	936	19	1	956	1,237	31	1	1,269
02	Engineering, aeronautical, jet ram	13	1	0	14	8	1	0	9	4	9	0	13	25	11	0	36
03	Engineering, aeronautical, jet-rocket	1	1	0	2	2	0	0	2	1	10	0	11	4	11	0	15
04	Engineering, aeronautical, dynamics	18	1	0	19	9	1	0	10	8	7	2	17	35	9	2	46
05	Engineering, aeronautical, aircraft structures	11	0	0	11	15	1	1	17	13	7	0	20	39	8	1	48
06	Engineering, aeronautical, compressibility	3	0	0	3	2	0	0	2	91	1	0	92	96	1	0	97
07	Engineering, aeronautical, flight test	3	0	0	3	16	1	0	17	20	9	0	29	39	10	0	49
08	Engineering, aeronautical, instruments	2	1	1	4	8	1	0	9	1	2	1	4	11	4	2	17
09	Engineering, aeronautical, rotary-wing	2	0	0	2	1	0	0	1	2	0	0	2	5	0	0	5
10	Engineering, aeronautical, general	330	24	1	355	424	47	0	471	330	167	4	501	1,084	238	5	1,327
11	Engineering, aeronautical, guided missiles	4	0	0	4	2	2	0	4	9	54	1	64	15	56	1	72
20	Engineering, electrical, general	742	26	1	769	344	31	1	376	530	57	4	591	1,616	114	6	1,736
21	Engineering, electrical, electronics	103	13	1	117	106	14	0	120	116	39	1	156	325	66	2	393
22	Engineering, electrical, power	26	1	0	27	20	2	0	22	13	1	0	14	59	4	0	63
23	Engineering, electrical, communications	44	3	0	47	32	1	0	33	28	15	0	43	104	19	0	123
24	Engineering, electrical, servomechanisms	5	7	0	12	0	5	0	5	5	6	0	11	10	18	0	28
25	Engineering, electrical, instrumentation	3	2	0	5	8	0	0	8	6	2	1	9	17	4	1	22
26	Engineering, electrical, armament	10	2	0	12	6	8	0	14	7	13	0	20	23	23	0	46
27	Engineering, mechanical, general	1,181	23	2	1,206	591	32	2	625	419	41	0	460	2,191	96	4	2,291
28	Engineering, mechanical engine design	11	0	0	11	23	2	0	25	17	0	0	17	51	2	0	53
29	Engineering, mechanical, hydraulic	1	0	0	1	8	1	0	9	0	1	0	1	9	2	0	11
30	Engineering, mechanical, diesel	4	0	0	4	3	0	0	3	4	0	0	4	11	0	0	11
31	Engineering, mechanical, thermodynamics	32	0	0	32	20	1	0	21	5	3	0	8	57	4	0	61
32	Engineering, nuclear (including reactor technology)	5	5	0	10	4	10	0	14	18	33	1	52	27	48	1	76

33	Engineering, chemical	323	6	1	330	156	7	1	164	72	18	2	92	551	31	4	586
34	Engineering, civil	609	17	0	626	445	16	0	461	272	59	0	331	1,326	92	0	1,418
35	Engineering, architectural	211	0	0	211	119	8	0	127	38	3	0	41	368	11	0	379
36	Engineering, petroleum	115	0	0	115	44	0	0	44	36	10	0	46	195	10	0	205
37	Engineering, textile	61	0	1	62	61	2	0	63	33	1	0	34	155	3	1	159
38	Engineering, safety	2	0	0	2	4	0	0	4	2	4	0	6	8	4	0	12
39	Engineering, industrial and production	241	6	0	247	153	10	0	163	100	37	1	138	494	53	1	548
40	Physics, general	204	12	3	219	263	26	0	289	170	37	4	211	637	75	7	719
41	Physics, nuclear	9	3	2	14	14	11	0	25	14	44	8	66	37	58	10	105
42	Geophysics	10	0	3	13	6	5	1	12	4	9	1	14	20	14	5	39
43	Physics, biological	5	0	0	5	8	3	0	11	9	0	1	10	22	3	1	26
50	Chemistry, general	358	12	10	380	517	25	4	546	262	20	3	285	1,137	57	17	1,211
51	Chemistry, nuclear	1	0	0	1	10	7	1	18	3	13	7	23	14	20	8	42
52	Chemistry, biological	15	3	1	19	65	7	0	72	38	6	2	46	118	16	3	137
53	Biology, general	177	3	1	181	261	16	2	279	68	7	0	75	506	26	3	535
54	Bioradiology (including radiological defense)	2	0	0	2	1	0	0	1	3	6	0	9	6	6	0	12
55	Bacteriology	22	2	0	24	24	10	0	34	11	8	0	19	57	20	0	77
56	Meteorology, basic	15	0	0	15	69	5	0	74	85	14	0	99	169	19	0	188
57	Meteorology, advanced	6	2	0	8	45	54	1	100	42	58	4	104	93	114	5	212
58	Geology	367	18	0	385	261	10	1	272	86	4	0	90	714	32	1	747
59	Metallurgy	57	6	4	67	21	6	0	27	13	2	1	16	91	14	5	110
60	Ceramics	10	0	0	10	17	3	0	20	7	1	0	8	34	4	0	38
61	Science, general	78	1	0	79	217	8	0	225	145	8	1	154	440	17	1	458
70	Mathematics, general	275	7	2	284	625	42	3	670	273	19	1	293	1,173	68	6	1,247
71	Mathematics, digital computation	5	2	0	7	0	1	0	1	2	0	0	2	7	3	0	10
72	Mathematics, linear programing	2	0	0	2	3	0	0	3	0	0	0	0	5	0	0	5
73	Mathematics, statistical	23	3	0	26	30	2	0	32	7	8	0	15	60	13	0	73
75	Business administration, general	1,437	21	0	1,458	2,362	85	1	2,448	1,040	304	6	1,350	4,839	410	7	5,256
76	Management (including advance management, etc.)	1,137	28	0	1,165	715	34	1	750	201	145	0	346	2,053	207	1	2,261
77	Accounting	772	2	0	774	888	26	0	914	221	19	0	240	1,881	47	0	1,928
78	Personnel management	110	2	0	112	126	10	0	136	53	17	0	70	289	29	0	318
79	Transportation	57	0	0	57	62	1	0	63	23	11	1	35	142	12	1	155
80	Engineering management (including industrial administration)	100	3	0	103	69	21	0	90	67	39	0	106	236	63	0	299
81	Research and development management	4	0	0	4	2	8	0	10	6	6	0	12	12	14	0	26
82	Public administration	21	0	0	21	42	6	0	48	12	10	0	22	75	16	0	91
83	Economics (including foreign economics)	931	15	1	947	942	38	4	984	362	23	1	386	2,235	76	6	2,317
84	International relations	35	2	1	38	58	16	3	77	68	58	3	129	161	76	7	244
85	Political science (in geopolitics)	589	5	0	594	554	45	3	602	226	35	5	266	1,369	85	8	1,462
86	Law	143	3	0	146	413	41	8	462	192	25	3	220	748	69	11	828
87	Psychology	318	10	3	331	451	50	5	506	157	47	12	216	926	107	20	1,053
88	Sociology (including social sciences)	271	3	0	274	554	37	3	594	210	8	2	220	1,035	48	5	1,088
89	Education	691	29	0	720	1,568	420	11	1,999	437	149	9	595	2,696	598	20	3,314

Air Force officers,[1] by academic fields and levels, by component—Continued

Code	Major academic field Classification description	Established DOS				Career Reserve				Regular				Grand total			
		B. S.	M. S.	Ph. D.	Total	B. S.	M. S.	Ph. D.	Total	B. S.	M. S.	Ph. D.	Total	B. S.	M. S.	Ph. D.	Total
90	Photogrammetry	4	0	0	4	7	2	2	11	0	0	0	0	11	2	2	15
91	Photography and cartography (including cinematography)	9	1	0	10	11	2	0	13	4	0	0	4	24	3	0	27
92	Criminology	12	1	0	13	19	1	0	20	11	3	0	14	42	5	0	47
93	Geography	95	0	0	95	87	12	0	99	39	4	0	43	221	16	0	237
94	Foreign languages	50	0	0	50	113	14	0	127	45	2	0	47	208	16	0	224
95	Journalism	185	2	0	187	298	15	1	314	91	5	0	96	574	22	1	597
96	Military science	0	10	0	10	162	1	0	163	1,750	14	0	1,764	1,912	25	0	1,937
97	Theology	4	1	0	5	16	1	0	17	1	0	1	2	21	2	1	24
99	All other	5,118	70	5	5,193	5,039	254	35	5,328	1,524	107	9	1,640	11,681	431	49	12,161
	Total	17,992	422	44	18,458	19,808	1,506	95	21,499	11,118	1,923	104	13,145	48,918	3,941	243	53,102

[1] Less medical, chaplain, and judge advocate.

Source: SSPS-506, Sept. 30, 1957. Compiled by AFPMP-1-C-3c.

Engineers

Major academic field		Established DOS			Regulars			Career Reserves			Total			
Code	Description	B. S.	M. S.	Ph. D.	B. S.	M. S.	Ph. D.	B. S.	M. S.	Ph. D.	B. S.	M. S.	Ph. D.	Grand total
01	Engineering, general	142	1	0	936	19	1	159	11	0	1,237	31	1	1,269
02	Engineering, aeronautical, jet ram	13	1	0	4	9	0	8	1	0	25	11	0	36
03	Engineering, aeronautical, jet-rocket	1	1	0	1	10	0	2	0	0	4	11	0	15
04	Engineering, aeronautical, dynamics	18	1	0	8	7	2	9	1	0	35	9	2	46
05	Engineering, aeronautical, aircraft structures	11	0	0	13	7	0	15	1	1	39	8	1	48
06	Engineering, aeronautical, compresibility	3	0	0	91	1	0	2	0	0	96	1	0	97
07	Engineering, aeronautical, flight test	3	0	0	20	9	0	16	0	0	39	10	0	49
08	Engineering, aeronautical, instruments	2	1	1	1	2	1	8	1	0	11	4	2	17
09	Engineering, aeronautical, rotary-wing	2	0	0	2	0	0	1	0	0	5	0	0	5
10	Engineering, aeronautical, general	330	24	1	330	167	4	424	47	0	1,084	238	5	1,327
11	Engineering, aeronautical, guided missiles	4	0	0	9	54	1	2	2	0	15	56	1	72
20	Engineering, electrical, general	742	26	1	530	57	4	344	31	1	1,616	114	6	1,736
21	Engineering, electrical, electronics	103	13	1	116	39	1	106	14	0	325	66	2	393
22	Engineering, electrical, power	26	1	0	13	1	0	20	2	0	59	4	0	63
23	Engineering, electrical, communications	44	3	0	28	15	0	32	1	0	104	19	0	123
24	Engineering, electrical, servo-mechanisms	5	7	0	5	6	0	0	5	0	10	18	0	28
25	Engineering, electrical, instrumentation	3	2	0	6	2	1	8	0	0	17	4	1	22
26	Engineering, electrical, armament	10	2	0	7	13	0	6	8	0	23	23	0	46
27	Engineering, mechanical, general	1,181	23	2	419	41	0	591	32	2	2,191	96	4	2,291
28	Engineering, mechanical, engine design	11	0	0	17	0	0	23	2	0	51	2	0	53
29	Engineering, mechanical, hydraulics	1	0	0	0	1	0	8	1	0	9	2	0	11
30	Engineering, mechanical, diesel	4	0	0	4	0	0	3	0	0	11	0	0	11
31	Engineering, mechanical, thermodynamics	32	0	0	5	3	0	20	1	0	57	4	0	61
32	Engineering, nuclear (including reactor technology)	5	5	0	18	33	1	4	10	0	27	48	1	76
33	Engineering, chemical	323	6	1	72	18	2	156	7	1	551	31	4	586
34	Engineering, civil	609	17	0	272	59	0	445	16	0	1,326	92	0	1,418
35	Engineering, architectural	211	0	0	38	3	0	119	8	0	368	11	0	379
36	Engineering, petroleum	115	0	0	36	10	0	44	0	0	195	10	0	205
37	Engineering, textile	61	0	1	33	1	0	61	2	0	155	3	1	159
38	Engineering, safety	2	0	0	2	4	0	4	0	0	8	4	0	12
39	Engineering, industrial and production	241	6	0	100	37	1	153	10	0	494	53	1	548
96	Military science	0	10	0	1,750	14	0	162	1	0	1,912	25	0	1,937
	Total	4,258	150	8	4,886	642	19	2,955	216	5	12,099	1,008	32	13,139

Scientists

Major academic field		Established DOS			Regulars			Career Reserves			Total			
Code	Description	B. S.	M. S.	Ph. D.	B. S.	M. S.	Ph. D.	B. S.	M. S.	Ph. D.	B. S.	M. S.	Ph. D.	Grand total
40	Physics, general	204	12	3	170	37	4	263	26	0	637	75	7	719
41	Physics, nuclear	9	3	2	14	44	8	14	11	0	37	58	10	105
42	Geophysics	10	0	3	4	9	1	6	5	1	20	14	5	39
43	Physics, biological	5	0	0	9	0	1	8	3	0	22	3	1	26
50	Chemistry, general	358	12	10	262	20	3	517	25	4	1,137	57	17	1,211
51	Chemistry, nuclear	1	0	0	3	13	7	10	7	1	14	20	8	42
52	Chemistry, biological	15	3	1	38	6	2	65	7	0	118	16	3	137
53	Biology, general	177	3	1	68	7	0	261	16	2	506	26	3	535
54	Bioradiology (including radiological defense)	2	0	0	3	6	0	1	0	0	6	6	0	12
55	Bacteriology	22	2	0	11	8	0	24	10	0	57	20	0	77
56	Meteorology, basic	15	0	0	85	14	0	69	5	0	169	19	0	186
57	Meteorology, advanced	6	2	0	42	58	4	45	54	1	93	114	5	212
58	Geology	367	18	0	86	4	0	261	10	1	714	32	1	747
59	Metallurgy	57	6	4	13	2	1	21	6	0	91	14	5	110
60	Ceramics	10	0	0	7	1	0	17	3	0	34	4	0	38
61	Science, general	78	1	0	145	8	1	217	8	0	440	17	1	458
70	Mathematics, general	275	7	2	273	19	1	625	42	3	1,173	68	6	1,247
71	Mathematics, digital computation	5	2	0	2	0	0	0	1	0	7	3	0	10
72	Mathematics, linear programing	2	0	0	0	0	0	3	0	0	5	0	0	5
73	Mathematics, statistical	23	3	0	7	8	0	30	2	0	60	13	0	73
90	Photogrammetry	4	0	0	0	0	0	7	2	2	11	2	2	15
91	Photograph and cartography (including cinematography)	9	1	0	4	0	0	11	2	0	24	3	0	27
93	Geography	95	0	0	39	4	0	87	12	0	221	16	0	237
	Total	1,749	75	26	1,285	268	33	2,562	257	15	5,596	600	74	6,270

Source: SSPS–506, Sept. 30, 1957. Compiled by AFPMP–1–C–3c.

Air Force Institute of Technology current program

	Fiscal year 1958		
	Length	Input	Produced to date
I. RESIDENT PROGRAMS (W-P AFB)			
1. Engineering sciences (undergraduate)	12 to 24 months	85	801
2. Aero engineering (graduate)	18 months	25	138
3. Electrical engineering (graduate)	do	40	107
4. Nuclear engineering (graduate)	do	20	36
5. Air ordnance (graduate)	24 months	15	23
6. A/C structural design (graduate)	9 months	20	101
7. Engineering administration (graduate)	18 months	25	90
8. Industrial administration (graduate)	12 months	25	432
9. Applied comptrollership (graduate)	do	25	23
10. Advanced logistics (graduate)	9 months	20	25
11. Basic installations (specialist)	9 weeks	200	703
12. Advanced installations (specialist)	7 weeks	50	681
Total		550	3,160
II. CIVILIAN INSTITUTIONS PROGRAMS			
1. Engineering	9 to 24 months	268	1,610
2. Biological and physical sciences	do	63	636
3. Arts and social sciences	do	67	1,092
4. Management	do	261	1,536
5. Air Academy instructors	do	55	29
6. Meteorology	do	400	1,582
7. Training-with-industry	12 months	82	356
8. Short courses	3 to 20 weeks	927	
9. Foreign languages	1 to 12 months	[1] 152	[1] 1,576
		[2] 2,397	[2] 5,627
10. Medical	9 to 24 months	519	2,390
11. Category C	Varies	[3]	1,942
Total		4,191	18,376
Grand total		4,741	21,536

[1] Officers.
[2] Airmen.
[3] No planned input.

Tuition costs—AFIT civilian institution program representative costs by course

[Based upon fiscal year 1957 fund obligations]

Subject field:	*Unit cost composite average*
Aeronautical engineering	$838
Civil engineering	693
Electrical engineering	886
Industrial engineering	926
Mechanical engineering	1,005
Nuclear engineering	1,112
Aerial photo reconnaissance	920
Geophysics	2,110
Mathematics	910
Nuclear chemistry	1,492
Nuclear physics	532
Physics	959
Physiology	667
Chemistry-biological	1,515
Electronic data processing	874
Meteorology	802
Average cost	1,015

Civilian Institutions with 25 or more students—enrollment as of Jan. 1, 1958

Institution	*Students*
Army Language School	216
California, University of, Southern	32
California, University of, Los Angeles	38
Chicago, University of	66
Colorado, University of	70
Florida State University	56
Foreign Service Institute	63
George Washington University	87
Georgetown University	38
Illinois, University of	42
Indiana University	50
Massachusetts Institute of Technology	47
Michigan, University of	100
New York University	36
Ohio State University	70
Oklahoma State University	138
Oklahoma University	80
Pennsylvania State University	41
Pittsburgh University	41
Sanz School of Language	29
St. Louis University	34
Stanford University	60
Syracuse University	357
Texas A. & M. College	85
Texas, University of	104
Washington, University of	63
Yale University	133

NOTE.—Excluding institutions conducting medical, category C reservists, and short-course programs.

Engineering—Enrollment as of January 1, 1958

[Institutions utilized]

Institution	Undergraduate	Master	Doctor	Total
Alabama Polytechnic Institute		1		1
California, University of, Berkeley	1	1		2
California, University of, Los Angeles	1	1		2
California, University of, Southern	1			1
Carnegie Institute of Technology		1		1
Clemson College	1			1
Colorado, University of	25			25
Columbia University		1		1
Florida, University of	2			2
Georgia Institute of Technology	3			3
Illinois, University of	21	13	1	35
Iowa State University	1			1
Maryland University	1			1
Massachusetts Institute of Technology	1	21		22
Michigan, University of	24	33	2	59
New Mexico, University of	20	1		21
Naval Postgraduate School		2		2
New Hampshire University		1		1
North Carolina State College	7	6		13
Ohio State University	5	3		8
Oklahoma State University	86	12		98
Oklahoma University	19	13		32
Pennsylvania State University	2			2
Princeton University		2		2
Purdue University	10	5		15
South Carolina University	1			1
Southern Methodist University		1		1
Stanford University	2	5		7
Syracuse University	1	2		3
Tennessee University		1		1
Texas A & M College	5	5		10
Texas Tech College	14			14
Texas, University of	27	6		33
Utah University	2			2
Washington, University of	16	4		20
Wyoming University		2		2
Total	299	143	3	445

Biological and physical sciences—Enrollment as of January 1, 1958

[Institutions utilized]

Institution	Undergraduate	Master	Doctor	Total
Boston University	3	5		8
Brown University	4	3		7
California, University of, Berkeley	2			2
California, University of, Southern			1	1
Colorado, University of		1	1	2
George Washington University		1		1
Illinois, University of		2		2
Iowa State University		3		3
Massachusetts Institute of Technology		2		2
Michigan State University	3			3
Michigan, University of		9		9
Naval Postgraduate School		1		1
North Carolina State College		5		5
North Carolina, University of		1		1
Ohio State University		10		10
Oklahoma State University		2		2
Oklahoma University		4		4
Oxford, University of		1		1
St. Louis University		3		3
Stanford University		21		21
Syracuse University	1			1
Texas A. and M. College		1		1
Texas, University of		1		1
Washington, University of		1	1	2
Total	13	77	3	93

Meteorology—Enrollment as of January 1, 1958

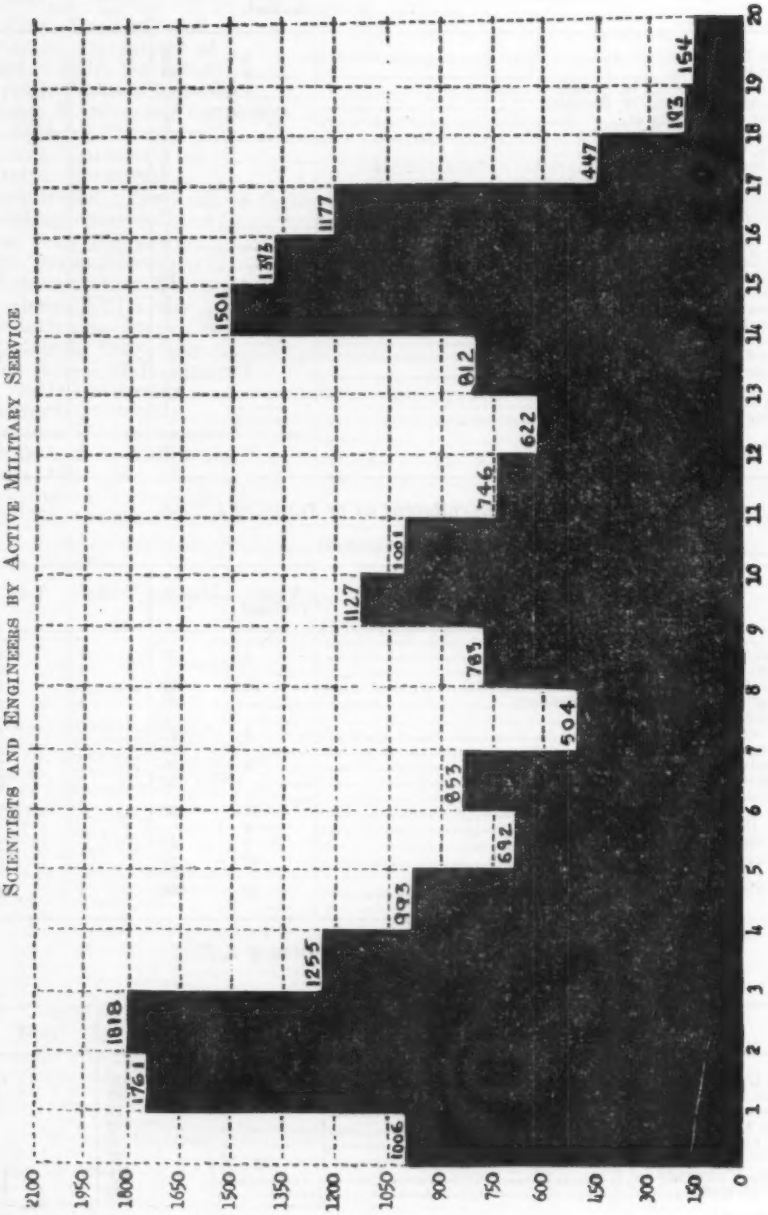
[Institutions utilized]

Institution	Undergraduate	Master	Doctor	Total
California, University of Los Angeles	4	27	1	32
Chicago, University of		9	1	10
Florida State University	32	22		54
Massachusetts Institute of Technology		20	1	21
Michigan, University of		3		3
New York University	3	31		34
Oklahoma State University		35		35
Pennsylvania State University	3	36		39
St. Louis University		30		30
Stockholm, University of		1	1	2
Texas A. and M. College	21	50		71
Texas, University of	3			3
Utah University	3	15		18
Washington, University of	10	27		37
Total	79	306	4	389

Language—Enrollment as of January 1, 1958

[Institutions utilized]

Institution	Officers	Airmen	Total
Army Language School	6	210	216
Foreign Service Institute	25	38	63
Georgetown University	6	27	33
Lacaze Academy	5	2	7
Naval Language School	1	6	7
Sanz School of Languages	2	27	29
Syracuse University		311	311
Yale University		133	133
Total	45	754	799


SCIENTISTS AND ENGINEERS BY ACTIVE MILITARY SERVICE
2100
1950
1800
1650
1500
1350
1200
1050
900
750
600
450
300
150
0
1761
1818
1255
993
692
853
504
785
1127
1001
746
622
812
1501
1313
1177
447
193
164
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
YEARS OF ACTIVE MILITARY SERVICE

General CARMICHAEL. Sir, that completes my prepared statement.

Mr. HÉBERT. Thank you very much.

Mr. COURTNEY. General, in looking over some of the statistics you have presented here, responding very properly as you did to the questions which related primarily to the physical sciencies and science as a subject, I notice that you have here some training programs for languages. What is your opinion as to whether or not language background is adequately supplied now for Air Force operations, in the many far parts of the world?

General CARMICHAEL. Sir, we consider our language requirement completely adequate. We meet all of the requirements of the security service, which is the principal user, the intelligence people in missions and air attachés. Most of our language training—the great majority of the students are enlisted personnel going into security service, our security service command.

Mr. COURTNEY. And your principal sources, I notice you mention, are the Army Language School, which I presume is at Monterey?

General CARMICHAEL. Yes, sir; one we are giving Russian language training at Syracuse.

Mr. HESS. Monterey is a Navy school.

General CARMICHAEL. Sir, there is an Army school at Old Presidio at Monterey. I believe it was the old cavalry post.

Mr. COURTNEY. General, I noticed you mentioned that the principal source of these language students is from the enlisted grades. What is your experience on attrition in that grade, I mean in those grades, after languages will have been developed?

General CARMICHAEL. I have no specific statistic that I can give you.

Mr. COURTNEY. Well, your best judgment of what your experience is.

General CARMICHAEL. The security service is deployed around the globe. The greater numbers of people in this type of work are overseas. So when they return from overseas they have no job in their specialty back here in the States.

Mr. COURTNEY. You mean their military specialty?

General CARMICHAEL. The military specialty.

Mr. COURTNEY. Yes.

General CARMICHAEL. So our experience has been, I would say—and I can correct this for the record—that in that particular specialty our retention has been less than 20 percent.

Mr. COURTNEY. Well, you don't consider that as a very adequate program, then, for your needs?

General CARMICHAEL. No, sir; we don't consider that as a very adequate reenlistment rate.

Mr. COURTNEY. General, this question on that same subject: Would you consider that the situation might be different if the program were extended to officer personnel, on a more elaborate basis than seems to have been done here?

General CARMICHAEL. In languages?

Mr. COURTNEY. In languages; yes.

General CARMICHAEL. We only send officers for whom there is a special need, mostly through military attachés, missions, and our military-assistance troops.

Now, I have not tried to connect language training with retention. I don't know how they stay.

Mr. COURTNEY. You don't know how that works out as a practical matter?

General CARMICHAEL. No, sir; but, generally speaking, most of the people that get into air attaché and military assistance work are career officers. Very few, if any, with a date of separation would be accepted into that type work.

Mr. COURTNEY. For example, how many have you who are qualified Russian-language students, in the several dialects, do you know?

General CARMICHAEL. I could try to get that answer for you.

How many there are in the inventory, I have no idea. Our program at Syracuse, both officer and airmen, runs about 500 a year, I believe—no, I believe it is 750 a year, and at Monterey it is about 350. I think I can get that answer.

Our total Russian requirement for fiscal year 1959 is for 766 airmen and 2 officers.

Now, about 500 of the 768 are in training at Syracuse, and about 166 or so at Monterey. The Syracuse program is much larger.

Mr. COURTNEY. What is the course of training in months? I notice over here on the chart: 1 to 12 months. Is that considered an adequate program?

General CARMICHAEL. It is currently 10 months, but there is a proposal to lengthen it to 37 weeks, if I remember. It is currently 6 months, and it is going to 10 months.

Mr. COURTNEY. That is at the Monterey School?

General CARMICHAEL. That is the proposal, to do it at both places.

Mr. COURTNEY. Now, do any of these sources lead to degrees?

General CARMICHAEL. In language training; no, sir. Most of the degree-getting courses—the large majority of them are in the engineering and science types, either with civilian institutions or at Wright-Patterson.

Mr. HÉBERT. Does Wright-Patterson give degrees?

General CARMICHAEL. Yes, sir.

The Engineers Council for Professional Development accredited the engineering school of the Institute of Technology 2½ years ago. They accredited us for 3 years, and it is subject to review again this fall.

Mr. COURTNEY. General, you stated that the largest input of your officer requirement, at least I so understood you, was the ROTC system.

General CARMICHAEL. Right, sir.

Mr. COURTNEY. But your experience there is a very high rate of attrition; is that right?

General CARMICHAEL. About a year ago—well, it was last summer, when we got authority from our Secretary to increase the length of time that we keep our pilots, our experience at that time was that about 75 percent of our pilots came from the ROTC source, and that 3 years later we were losing about 75 percent of them.

Mr. COURTNEY. Now, is your answer to that problem, or to that rate of attrition, twofold: One, that the pay situation be improved, and what else?

General CARMICHAEL. Well, sir, I think life in general has to be improved within the Air Force. I don't think it is strictly a con-

gressional solution insofar as pay is concerned. I think pay is vitally important. But I think that we in the Air Force have to do as much as we can to improve life, too. This matter of moving overseas and moving here and there: We are trying our best to reduce the number of moves that have to be made.

We have a very hard-hitting retention program, and a reenlistment program. All of our unit commanders have been brought into play and they are doing everything that they can to accomplish the job and still take as much of the misery out of life as possible. But there is no doubt but what we need a pay adjustment of some sort.

Mr. COURTNEY. But that is not the whole answer, in your opinion?

General CARMICHAEL. That is right.

Mr. COURTNEY. General, these ROTC men are all in the lower grades. They come in as second lieutenants, I believe.

General CARMICHAEL. They all come in as second lieutenants.

Mr. COURTNEY. And, generally, they will have left by the time they reach the grade of captain, isn't that right?

General CARMICHAEL. They are eligible for promotion from second lieutenant to first lieutenant after 18 months. And a great majority of them qualify and are promoted. Another 18 months and they are eligible for separation. So the big exodus in the Air Force of the officers is at the first lieutenant level.

Mr. COURTNEY. General, have you any program or do you think of any program which would induce extension by these ROTC people? You have cited a few of them. Housing, I believe, was one, and limitations on movements in foreign assignments, for example.

General CARMICHAEL. We have found that moves of our young officers, as most of our airmen—the main reason that they get out is that opportunities on the outside appear brighter to them.

Now, of course, in the last few months that situation apparently is changing. Any change in the overall economy of the United States makes a corresponding change in the numbers of people who stay with us, and in the degree of difficulty of recruiting people. But the main reason that they get out is, in the case of the ROTC officers, that they have never intended to make the Air Force a career when they first entered the program.

Mr. HÉBERT. That is the real point. I was going to ask you that question. The ROTC kid is just a kid that is going to do his obligated duty and leave.

General CARMICHAEL. Yes, sir. He looks at ROTC as meaning—Reserve officer training.

Mr. HÉBERT. That is right.

General CARMICHAEL. Training for the Reserve Officers' Corps. But when—in 1953, when the Department of Defense stated—and this was during the Korean war—that all officers from all ROTC programs must serve 2 years of active duty within 12 months of graduation. And up to that time they had been exempt from active duty. When that became the law, in the Reserve Officers' Act of 1955, in effect as far as the Air Force is concerned we faced up to the fact that the ROTC was no longer training for the Reserve Forces. It is our primary source of officers for the Active Establishment.

Mr. HÉBERT. But didn't the Air Force in that area, General, contribute a little bit to the demoralization of the ROTC individual? At

one time, I think it was 2 or 3 years ago, they just cut off the officers and they could only go in as sergeants, or something.

General CARMICHAEL. Sir, at that time—and that was the class of 1954.

Mr. HÉBERT. Yes.

General CARMICHAEL. At that time, that was the first class to come on board. Under the ceilings and dollars available at that time, there was room for a very few nonrated officers. All of those who were not qualified for flying or willing to fly we couldn't use.

So at that time we issued them certificates of completion. Now that entitled them to come into the Air Force as airmen third class, serve 2 years, and then get a Reserve commission and get out, having satisfied their obligation.

About 5,000 got certificates of completion. Of that 5,000 about 3,500 finally got into the Air National Guard as second lieutenants and came on and served 2 years with the Air Force on active duty training.

Mr. HÉBERT. It wasn't keeping faith with them when they first came in. They came in intending to come out as second lieutenants in the ROTC and then when they were ready to go in as second lieutenants the Air Force told them they couldn't come in, but come in as sergeants.

General CARMICHAEL. It was difficult to take; yes, sir. There was no other apparent solution at that time. I just arrived at the Pentagon when that was underway, so I don't know too much about it, Mr. Chairman. I would say since that time, though, we have had increasing indications that the morale of the ROTC is very sound. And the motivation of the ROTC for the Air Force is improving. But it hasn't reached the degree that we——

Mr. HÉBERT. It suffered a terrific setback at that time, from which it has not recovered.

General CARMICHAEL. Well, sir, I can't agree that it hasn't recovered. We deal very closely with ROTC.

For instance, this year's senior class: On the 1st of February those who were enrolled as pilots and navigators, or future pilots and navigators, had previously been told that on the 1st of February they had to elect either to accept this 5-year tour, that is 4 years after getting their pilots' wings, and that takes a year to get them, or take a 3-year nonrated tour, that is, nonflying tour; of those enrolled in category 1, which is future pilots, 63 percent of them took the 5-year tour, and they were committing themselves not only to 5 years, but to anywhere between 5 and 6 years, because we call them in increments over a 12 months' period. We don't call them all at one time.

So we have almost two-thirds of these youngsters willing to commit themselves to the Air Force for 5 to 6 years, and we think that is a pretty high motivation and pretty high morale.

Mr. HÉBERT. Haven't you found additional trouble in the area where ROTC candidates graduate as lawyers and you called them up before they received their law degree?

General CARMICHAEL. Sir, I know nothing about the lawyers or the medical people. I can speak about the officers of the line, but not about the specialists.

Mr. HÉBERT. They are not specialists.

General CARMICHAEL. They are handled separately.

Mr. HÉBERT. No. This is the situation. I think this should be developed on the record to show what you are running into, and which I think has been resolved to some extent. Up until last year, some time during the year, all services were at fault in this particular area.

Under the law, or under the regulations, the ROTC individual was allowed to receive a degree, I mean for his deferment, and then called to active duty.

(General Carmichael nods.)

Mr. HÉBERT. And the degree was to be assumed, that is, the objective degree, but it was being used as the intermediate degree. In other words, you take institutions which have large law schools, and have ROTC students in those law schools. These individuals entering the schools would enter to receive a law degree, but no school today, a law school worth its salt, will allow an individual to graduate in 3 years, in law school. They must have their prelaw. And along the line, along the road, they are able to pick up the baccalaureate degree or a bachelor of arts degree, or whatever they happened to be majoring in, and continue to receive their objective degree of law. The Air Force along with the Navy, the Army, and the others, were calling these youngsters up and interrupting their education before they received their objective degree. Under a ruling last year from the Secretary of Defense's Office, and Mr. Milton's office, my appreciation or understanding of what has been done is that with the exception of the Air Force, that the individual will be allowed to obtain his ultimate or his objective degree. The Air Force, I understand, has served notice that they are going to call them up—the Air Force will call up the individual at the end of 4 years. Now, he is put on notice. Is that correct?

General CARMICHAEL. We don't have any lawyers in our ROTC program.

Mr. HÉBERT. You don't?

General CARMICHAEL. No.

Mr. HÉBERT. I have one right now who wants to wait until he finishes law course.

General CARMICHAEL. Well, sir, there may be 1 or 2.

Mr. HÉBERT. Well, there are some. Because this thing was a nationwide thing. I was very much involved in it, and that is the reason I am trying to get it out, to find out exactly where we stand. Because I thought the whole situation was settled. And only the other day I received a letter from a young second lieutenant in the Air Force who has 1 year to complete his law degree, and the Air Force wants to call him up, which is in violation, as I understand, of the agreement reached last year, except for the individuals who went in this year.

General CARMICHAEL. Sir, one of the prerequisites for getting a commission from ROTC is to get a degree.

Mr. HÉBERT. They get the degree.

General CARMICHAEL. We don't give the man a commission unless he gets the degree.

Mr. HÉBERT. That is correct. They get the B. A. or the B. S. on the way. That is an intermediate degree. They can't get the law degree. They go in to be lawyers, but the services interrupt them and when they get that first degree, which is only an intermediate

degree—it is not their objective degree. They didn't enter in the school and matriculate in the school to get that B. A. or B. S. They went in to be lawyers. They believed they were to get their degree in law, in their profession, the chosen profession. Yet the services were interesting these individuals and calling them to active duty after they received their first degree, which they pick up along the way. They could every easily say "We don't want the degree." They could naturally do that. As of right now, I have a letter on my desk of an individual in the Air Force ROTC who needs 1 more year to complete his law course, and he has been called to active duty. Now, that doesn't seem to me to be proper.

General CARMICHAEL. Sir, you are telling me something I didn't know. I didn't know we had lawyers in our ROTC program.

I will certainly check that one.

Mr. HÉBERT. Maybe not the lawyers in the program, per se. For instance, the Navy has switched too, since this happened. The Navy has switched to this extent, that in the NROTC program, the Navy will not allow one of their NROTC students or candidates to take law as a major—that is to major in law. Or medicine. So they have served notice on them, which is perfectly proper as far as I am concerned, and I think right. In fact, one dean of a law school—Tulane University—objected and I told him he was not on sound ground at all. Because if that youngster is told before he starts on the course that he can't get that law degree and he has to accept under certain conditions, then he goes in warned. But in the case of the individual where the individual has gone in and then has been refused the opportunity of getting the degree for the profession he wants to pursue—well, I don't think that is quite right.

General CARMICHAEL. Well, sir, I am inclined to agree with you. Although we do have a category C delay program.

Mr. HÉBERT. What does that consist of?

General CARMICHAEL. Anybody in ROTC who can get a master's degree——

Mr. HÉBERT. I am not talking about the master's degree.

General CARMICHAEL. Within a year, we will let him stay out and remain out for a year's time.

Mr. HÉBERT. I am not talking about the master's degree. Or the medical degree.

Do you have something to say on that, General?

General CARMICHAEL. No, sir; I am just getting somebody to look into it, because I want to find out about that case.

Mr. HÉBERT. I don't want to belabor the hearings, of course, on it, but I will be very glad to give the boy's letter to you.

General CARMICHAEL. Sir, I would like to see it.

Normally, when these people sign the contract entering advanced ROTC, which is at the beginning of their junior year, they agree to accept a commission upon successful graduation and successfully getting a degree. But that would be a degree at the lowest level.

Mr. COURTNEY. That is an additional 2 years that you are talking about there.

General CARMICHAEL. That would be a total of 4 years of schooling, whatever degree you get out of that.

Mr. HÉBERT. That is right.

General CARMICHAEL. But the individual in order to get his objective degree has to have 6 or 7 years. So if you dislocate the educational procedure, then you have done a disservice to the individual. However, we will talk to you about it later.

POLICY CONCERNING CATEGORY C (EDUCATIONAL) DELAYS FOR AIR FORCE ROTC GRADUATES

1. Delay policies in effect prior to December 26, 1957 (AFR 45-26)

a. Air Force ROTC graduates appointed or enrolled as cadets in Air Science III or IV on or before April 30, 1956, may upon graduation and appointment, be delayed from entry on EAD until they complete the academic work required for the award of a graduate degree, including bachelor of laws, or a degree in medicine, dentistry, veterinary medicine, or allied health specialties.

b. Air Force ROTC cadets initially enrolled in Air Science III on or after May 1, 1956, may upon graduation and appointment, be delayed from entry on EAD only for a sufficient period after appointment to complete the academic work required for the award of a master's degree, normally awarded after one year of graduate study. Delays will not be granted for any degree other than a master's degree, except for Rhodes or Fulbright scholars.

2. Delay policy currently in effect as of December 26, 1957 (AFR 45-31)

a. Air Force ROTC graduates may be delayed from entry on extended active duty long enough to complete the academic work required for a master's or law degree.

b. Upon completion of academic work required for the award of a master's degree, an Air Force ROTC graduate may be further delayed to attain a doctorate, provided the sequence of study is of value to requirements of the Air Force. Additional educational delay will not be granted for any other degree, except for Rhodes or Fulbright scholars.

c. Air Force ROTC graduates enrolled or accepted for enrollment in a recognized theological or divinity school and preparing for ministry will not be ordered to EAD until they have been ordained or graduated from the seminary or withdraw from such studies.

d. Individuals will not be granted a delay for the purpose of receiving advanced education in the field of medicine, dentistry, veterinary medicine, or allied health specialties.

e. Air Force ROTC graduates scheduled for meteorology training are not eligible for education delay.

Mr. HÉBERT. Because many of these cases—I mean I am very familiar with them, and I was interested in what you are saying there about the ROTC student. However, I do heartily agree with you that the normal ROTC student goes just for that, the Reserve Officers' Training Corps and that is it, and he has no intention of making the military a career.

General CARMICHAEL. That is not a static thing. We hope, Mr. Chairman, we are exercising a motivational influence where more and more of these people are entering the program specifically for a career in the Air Force.

Mr. HÉBERT. I think Mr. Hess wanted to pursue that. That is in line with the Holloway plan. That is a different program.

Mr. HESS. Yes, I believe, General, you said in your statement that you were considering a plan similar to the Holloway plan that the Navy has.

General CARMICHAEL. Yes, sir.

Mr. HESS. In what way would that be any different than the ROTC program you have now, with the exception, of course, of paying the boys while they are going through?

General CARMICHAEL. Well, sir, we think we could select—for instance, the Navy, in their Holloway plan, enter about 2,000 young-

sters a year, into college. Now, they select from applicants numbering in the order of 25,000.

Mr. HESS. That is right.

General CARMICHAEL. Now, we think if we had a program that would attract that number of applicants, that we could identify and select the people with 90 percent confidence who would make the Air Force a career.

Mr. HESS. I see.

General CARMICHAEL. And definitely we would require at least a 5-year minimum initial obligation. And anybody who would commit himself to those number of years we feel is pretty well career-minded, or it is very difficult to change your mind and start all over again when you are 28 or 29 years old.

Mr. HESS. What is your attrition in the Air ROTC?

General CARMICHAEL. You mean during ROTC or after——

Mr. HESS. No; after they have served their required time.

General CARMICHAEL. Well, sir, I didn't have time to run the percentages on these. The ROTC second lieutenants who came on board in fiscal year 1953—that would be July 1 of 1952. We took on 5,910. Today we have remaining 1,385.

Of those that came on in 1954—that is thirteen fifty-ninths.

Mr. HÉBERT. That is splitting hairs.

Mr. HESS. Twenty-three percent.

General CARMICHAEL. We took 9,200 in 1954, and we have remaining 2,100. In 1955, we took 9,080 and we have remaining 4,400.

Now, in 1955: That means they came on board after July 1, 1954. So they weren't eligible to get out until the beginning of July 1, 1957.

Mr. HESS. 1957.

Mr. BECKER. And you're retaining how many? 4,400.

Mr. HESS. That is different.

General CARMICHAEL. 4,400 out of 9,000.

Mr. HESS. Of course, you feel that with the adoption of a plan similar to the Holloway plan, you would cut that attrition down materially, because you would have the selection of the boys who went in to take the course.

General CARMICHAEL. Yes, sir; I think we would have greater selection. We could employ more refinements, and more selective devices to identify the people that have not only a potential in intelligence, but also motivation toward the Air Force.

Mr. HESS. You would have a requirement of 5 years then, of service.

General CARMICHAEL. I would say at least, a minimum requirement of 5 years of service, we figure to get our investment back.

Mr. HESS. Would you abolish the ROTC plan then?

General CARMICHAEL. No, sir.

Mr. HESS. You would continue that also?

General CARMICHAEL. I think we would just gradually work it into the ROTC program, to where ultimately 5, 6, or 7 years from now we would have no one but the subsidized students in ROTC.

Mr. HESS. Well, in ROTC you have no selection, the way you would have under the Holloway plan.

General CARMICHAEL. Sir, what I mean is that we would have for a while a mixture of ROTC as it is now with the subsidized students.

Mr. HESS. Yes.

General CARMICHAEL. But we are gradually entering into ROTC only from subsidized sources. In 4 or 5 years that would be all we would have.

Mr. HÉBERT. The same as the Navy plan.

General CARMICHAEL. Yes, sir.

Mr. HÉBERT. The Holloway plan is a subsidized plan and still they have the same naval units on the same campus.

Mr. HESS. Yes.

General CARMICHAEL. I would like to emphasize, sir, these are my personal ideas and I haven't cleared them with my immediate boss, and especially my Chief of Staff.

Mr. HÉBERT. It is always refreshing to get original ideas before the committee.

General CARMICHAEL. I agree with you, provided my boss doesn't disagree with me.

Mr. KITCHIN. I just wanted to get back to what I understand the purpose of these hearings are, which is the lack of the adequacy of scientists and engineers.

I didn't hear the general's statement at the outset. I am sorry I had to be late, because I was with another subcommittee.

But I see a statement here in your written statement that would indicate that there is in your opinion an inadequate number of scientists and engineers to fill those positions over which you have cognizance; is that correct?

General CARMICHAEL. Yes, sir.

I would say to a degree.

Mr. KITCHIN. To what degree?

General CARMICHAEL. We can generally fill them, that is we can procure the numbers that we need, but once we get them and keep them for the minimum 3-year tour, we can't keep them. And we have a very high rate of turnover.

Mr. KITCHIN. Then that is a competitive proposition, or other elements entering into it, rather than a lack in numbers or quality of graduate engineers and scientists; is that right?

General CARMICHAEL. With the exception of meteorologists we can generally get the numbers that we need. But we can't keep them and therefore we keep replacing a man who served 3 years, and who has really gotten to be or just about gotten to be really proficient——

Mr. KITCHIN. Yes.

General CARMICHAEL. We have to replace him with a brand new second lieutenant, who has to learn all over again the job that an experienced man could do twice as well.

Mr. KITCHIN. Well, the point that I wanted to make is—or let me ask this direct question. Other than the competitive atmosphere that now exists between private industry and private groups with the Air Force, it is your opinion that there is an adequate number of scientists and engineers from which the Air Force could draw if their program would allow them to be retained once they were in the Air Force?

General CARMICHAEL. Well, just as a straight yes or no answer, I would have to say yes, Mr. Kitchin. But I would say that, certainly, the bigger the reservoir from which we draw the better is going to be the person that we draw, that we take on board.

Mr. KITCHIN. That, naturally, is to be assumed. Now, the next question, if you would, General. I don't know whether you made a survey into this particular phase of it. In the next, say, 5 to 10 years, is it your opinion that there will be a sufficient number to meet the military requirements of your particular branch of the service, in the event your program is stepped up from a pay increase or whatever would be available to retain these people? Do you think within the next 5 to 10 years there will still be adequate scientific and engineering personnel from which to draw?

General CARMICHAEL. Well, sir, in my personal opinion, there will be adequate numbers if you are willing to accept the standards that we are accepting now. I think that, as we get into this age of space, we should take on board, to begin with, a man who is much more highly educated and much more capable than the people we are now getting.

We ought to have better educated people. That is, the degree in engineering should mean more, and it will mean more, because all of these engineering colleges today are hard pressed keeping up with the times to pack in everything that they want to pack in and still graduate a student within 4 years.

The trend is toward a 5-year engineering school.

I think there has to be a qualitative increase in the type of person that we get. But, as far as numbers are concerned, our experience now indicates that, assuming the Air Force doesn't double in size and assuming a lot of things, I think we can attract the numbers we need even 5 years from now.

Mr. KITCHIN. But, on the qualitative basis, you still think that there probably will be a shortage 5 to 10 years from now of that type of engineer and scientist that you require.

General CARMICHAEL. I tell you there is a shortage today, because the people that we have today we have to send to further schooling because they are not——

Mr. KITCHIN. That brings up the next question. I have been led to believe by numerous sources in private industry that the program that has been existent—the anxiety on the part of the industry to acquire these scientists and engineers.

General CARMICHAEL. Yes.

Mr. KITCHIN. Where they go into a college or a university and are offered during the freshman or sophomore year a job at some announced figure upon his graduation——

General CARMICHAEL. Yes.

Mr. KITCHIN. I have been advised that that has hurt the program of engineers and scientists to the extent that it more or less takes away the initiative of the individual student, feeling that he does not have to compete for a job but he has it made, and he has it made in the early stages of the game, and he then loafs or coasts through his engineering or science course, with the idea that he doesn't have to compete with the other members, he has it made, and he has a job when he gets out. And I have been led to believe that we are producing more mechanics than we are engineers, to that extent. Is that your experience?

General CARMICHAEL. I think, sir, you certainly evidence a greater knowledge than I do of that, but I think it would only be human nature that, if you had your future assured for you, you wouldn't work as hard as if you had to get out there and take your chances.

Mr. KITCHIN. That is all, Mr. Chairman.

General CARMICHAEL. Incidentally, we found a lot of our second lieutenants, in ROTC, have entered the Air Force for a 3-year tour. They have been on company payrolls, too, and they have been drawing, whatever—one lad, I remember, went to work for Union Carbide, and wasn't called for about 11 months. We interviewed him at one of the basic flying schools. At the time he entered active duty his take-home pay was $545 a month. The company said, "Son, you serve 3 years and come back to us; we will pay you the difference between your Air Force pay and $545"—that is, take-home pay would be the same. And, furthermore, he would not lose any seniority rights during that 3 years.

Mr. KITCHIN. And that continued during his tour in the Air Force?

General CARMICHAEL. Yes, sir.

Mr. COURTNEY. Well, that is a specific provision of the statute. Many officers who served during World War II were given the difference between the company pay and the Army pay.

Mr. BECKER. Yes.

Mr. KITCHIN. That is a continuing proposition, even now.

Mr. BECKER. Yes.

Mr. COURTNEY. The principle is the same.

Mr. BECKER. Yes.

Mr. WILSON. General, I would like to ask you a couple of questions about this. Your ROTC program in the technical schools, like Cal Tech, MIT, Lowell, Stevens, and these other institutes of technology; do you have large Air Force ROTC programs in those schools?

General CARMICHAEL. It is a very small program at Cal Tech. A very small program at MIT. Relatively small—I don't remember the exact enrollment figures. California Institute of Technology; last summer we graduated a total of 17 people. The average number of cadet enrollment was 107. At MIT we have an average number of cadets—860 in, and last year they graduated 40.

So, that is a pretty large size program.

Mr. WILSON. You are kind of spinning your wheels on those that are going through those ROTC programs, according to your percentage figures, when only 5 percent of them indicate any interest in staying in. Isn't there some way to make the ROTC program in these technical schools attractive enough so you can obligate them for a little longer period of time than the average? I think if you keep a man in the service as long as 5 or 6 years, where he gets his pay up somewhere comparable to what it is on the outside, that you have a chance of retaining him.

General CARMICHAEL. Well, sir, that certainly is true. That is the philosophy behind our decision last August to require 5 years from the future pilots and future navigators. At that time, we proposed also to the Secretary to have for those going into the nonflying fields their obligation raised from 3 to 4, but with the fliers, we could say, "You could take the 5-year tour or a 3-year nonflying tour." With the nonrated people we have no alternative other than to say, "You either take 3 years or get out."

And it was the judgment of the Air University and ROTC that 75 percent of them would refuse the 4-year tour and drop out of the program.

Mr. WILSON. Well, can a man actually contribute anything to the Air Force with only 3 years of obligated service in a technical skill, such as engineering and so forth?

General CARMICHAEL. I would say that in the highly technical—in the research and development business in the missiles, he would make some contribution, but I don't think we would realize half of his potential within the 3 years' time.

I don't think he would have progressed to where he is paying off 100 percent of what he is able to give.

Mr. WILSON. It is your problem. I don't know what the solution is.

General CARMICHAEL. We are not sure——

Mr. WILSON. But it seems to me you must work out some way to quit just revolving these people through and not getting any appreciable advantage out of their training.

General CARMICHAEL. And with the fliers, we hope that those who commit themselves stay in 4 years after they get their wings. And the ROTC means a minimum of 5 years, and anywhere between 5 and 6 years.

We hope that the people who are motivated and willing to make that type of a decision are going to stay with us in greater numbers at the end of the 5-year period. We don't know for sure.

There are a couple of West Pointers who made a study—that is, a couple of professors at West Point made a study—that might tend to refute that. I read this in Look magazine, an article, I guess it was in an issue during February. But they showed the class of 1946, I believe—because of the Korean war, they were required to stay in for 5 or 6 years, but a surprisingly large number, and as I remember, over 20 percent, had gotten out after their obligation had been finished, even though it was a long obligation.

But the Air Force is different, especially in the pilots. The reason a lad comes to the Air Force, really, is to fly an airplane. That is the strongest motivator we've got, is the airplane that we fly.

Mr. BECKER. Mr. Chairman, if I may——

Mr. HÉBERT. Why, certainly, Mr. Becker.

Mr. BECKER. General, you mentioned before, the standards under which you are bringing them in now. What did you mean by that?

General CARMICHAEL. Well, sir, I meant that now we accept from some 188 colleges, people who meet the academic standards of that institution.

Mr. BECKER. What would they be—high, low, or indifferent?

General CARMICHAEL. We have little colleges, big colleges, State colleges, private colleges, Ivy League colleges, colored colleges—we've got all types, with all varying degrees of standards.

If we can pay these people and hope to keep them, we would like to have, say, the engineering standards and science standards of MIT.

In the liberal arts, those that we use, and in other standards, we would like a standard high, of the Ivy League type, where attrition over a 4-year period sometimes is only 3 or 4 percent per class, whereas some of the schools in other parts of the country have an attrition that is higher.

Mr. BECKER. Now, assume you get a pay increase, that you mentioned, and the chances are you will. Do you think, then, you will increase the standards, be able to increase the standards?

General CARMICHAEL. Well, sir, I hope that first an adjustment of our pay system and an increase in pay would cause more people who are with us to stay on. I would hope that it would increase ROTC and all of our other procurement sources, that is, increase the numbers that apply.

And any increase in numbers, with a constant intake, always gives you a better selection and thereby an increase in the standards of the people that we take on.

Mr. BECKER. Isn't it a fact, General—you talk about these standards—that the standards have had to be lowered in recent years, or taking men in because the standards of the schools have been reduced?

For example, we have had a regent system in my State, and I know we had to reduce the regent's qualifications. Because of the standard of education in the schools today.

How in heaven's name are you going to turn out technicians, engineers and scientists, when they don't even take the courses in school, when they go in school and elect in high school not to take certain courses that are required in the sciences?

In other words, they are taking the easy way out: go through school and get a high school diploma, go through college and get a bachelor of arts degree. But what do they know as far as these technical services that you need?

That is why I am talking about standards here. What have you had to do with your standards in relation to the education being taught in the schools generally today?

General CARMICHAEL. Yes, sir. The product that we get as an ROTC second lieutenant, except for a very small number that we control, or specify the courses that they should have—by and large the great majority of the ROTC second lieutenants are a direct reflection of the educational standard of the college they attend. Because we have no academic requirement, other than that they get a degree from their college.:

Mr. BECKER. Now, you are getting down to exactly what I am talking about, General. You had to modify your standards because of the education being taught the students in the schools today?

General CARMICHAEL. Yes, sir.

Mr. BECKER. You have had to modify it?

General CARMICHAEL. Any time a university or a college that has Air Force ROTC in it raises or lowers its standards, in turn, that either helps or hinders the standards of the Air Force.

Mr. BECKER. You can put that in the record. I say that the educational system promoted by John Dewey and Professor Counts and Rugg of Columbia University, is what put you in the position that you are in today, of reducing the standards necessary to meet the requirements of coming in, not only to the Air Force, but any of the forces.

Mr. HÉBERT. And the country, too.

Mr. BECKER. Throughout the country.

Mr. HÉBERT. I am agreeing with you. I fought that for years, and I welcome brothers in the tent.

Mr. BECKER. I fought it through the years in the State legislature.

Might I say this, Mr. Chairman, that in the graduates of our high schools today—when we talk about the great science scholarships we

want to give them, who are we going to give them to, when they don't have the requirements when they graduate from high school?

And you won't get them in the Air Force. That is why I oppose—I say it has no basis here in the committee—money for school construction and money for all these things.

What about the education they are getting in the schools? It is more important by far than swimming pools and gymnasiums and bands and music lessons, and everything else in the school, that we are paying for.

Mr. HÉBERT. And football players.

Mr. BECKER. I don't mind football players. They will make good soldiers, too, a great many of them.

But I wanted to get at that, General, particularly at your standards and your requirements. You had to reduce them through the years, because you are not getting the quality necessary to maintain a high standard that is necessary for the forces.

I might also add, too, General, while I am at it, they are not being taught loyalty and patriotism and love of country in the schools, either, that would want to make them stay in the military forces and serve in the military forces.

Mr. WILSON. You sound a little bitter.

Mr. BECKER. I am bitter about it.

When I graduated from grammar school, I was taught love of country. I knew all about the Revolutionary War.

Mr. HARDY. Would the gentleman yield?

Mr. BECKER. Yes.

Mr. HARDY. You wouldn't suggest—that we provide all these high-powered educational advantages and scientific advantages and still not give them the sociological capabilities to enjoy them? [Laughter.]

Mr. HÉBERT. All right.

Mr. WILSON. Mr. Chairman, a few questions.

Mr. HÉBERT. All right.

Mr. WILSON. General, have you given any consideration to reducing the number of ROTC candidates and perhaps increasing their motivation by increasing their pay—in other words, with the same amount of money concentrating on fewer ROTC people and obligating them a little longer period in order to keep them in?

General CARMICHAEL. Well, Mr. Wilson, the great majority of the ROTC enrollment is enrolled either in category 1 or category 1A. That is, they are physically and mentally qualified to be pilots, category 1, or navigators, category 1A.

Our enrollment in category 2, which is scientific and technical: the authorization is only 960, and our senior enrollment is something less than 700 this year.

And then we have a token of some 200 in what we call category 3, that is neither flying nor technical, but outstanding lads, otherwise.

Of this majority—as I say, it is something over 75 percent, being in the flying fields. They now in order to get to fly have to sign up for 5 years minimum, or 4 years from the time they get their wings, which means some people will get in and serve 5 years, but some people will be delayed 11 months before they are called to active duty.

It takes another 12 months to get their wings. And then they are still obligated to 4 years.

So, for 75 percent of ROTC, we are demanding a longer tour. We have jumped from 3 years to 5 years.

Mr. WILSON. Well, fliers have motivation. You are going to give some of these engineers some motivation through offering them better pay or something, or better training.

General CARMICHAEL. Category 2, those enrolled and not qualified for flying, that is the 960 quota. That is not our only source of engineers, because in the category 1 and 1A, the future pilots and navigators, anywhere from 30 to 40 percent will have engineering degrees. And after they have gotten into the Air Force and have flown a tour in the cockpit seat 3 or 4 years, they are still available, even though they have wings, for further education or for engineering assignments.

Mr. WILSON. That is all, Mr. Chairman.

Mr. KITCHIN. Did I understand you to say that some of these technical institutions, of the 188 that you mentioned there—the colleges you are getting these boys from—that there are instances where they have an engineering degree and still have to send them off for further education before you can use them to your advantage?

General CARMICHAEL. No, sir, Mr. Kitchin.

Mr. KITCHIN. I was wrong in that impression, then?

General CARMICHAEL. The engineering degrees that some of them have are not sufficient to go and proceed on into select schools to get a master's degree, in some cases.

Mr. KITCHIN. Well, on a comparative basis, now, do you find that you have engineers that receive engineering degrees from Cal Tech or MIT that do have that capability, where you find engineers who are receiving an engineering degree from some other institution who lack the ability to perform?

General CARMICHAEL. Yes, sir.

Mr. KITCHIN. So there is that distinction, from which school they get the engineering degree, as to how well educated they come to the Air Force; is that right?

General CARMICHAEL. Yes, sir. There is a direct influence there. To get a masters' degree, for instance, at Cal Tech, an engineer from some school in some other part of the country may or may not be accepted by Cal Tech, depending upon the courses that he took and the grades he made. It all depends.

Mr. KITCHIN. Yes.

General CARMICHAEL. For instance, the Air Force Academy will graduate people with a B. S. degree, a bachelor of science degree, but only about the upper 10 percent of them will be sufficiently qualified to go directly to Cal Tec. Cal Tec wouldn't take them. They would have to take other courses and make better grades.

Mr. KITCHIN. All right. That is all, Mr. Chairman.

Mr. COURTNEY. Will you proceed, Mr. Watts, with your statement.

STATEMENT OF MR. JOHN A. WATTS, DIRECTOR OF CIVILIAN PERSONNEL, DEPARTMENT OF THE AIR FORCE

Mr. WATTS. Mr. Chairman and gentlemen of the committee, I am John A. Watts, Director of Civilian Personnel of the Air Force.

I understand that the committee is interested in civilian scientists and engineers, particularly in matters relating to numbers of personnel, their recruitment, development, utilization, and retention. I understand, also, that you are vitally concerned with agency plans for improving the development and use of scientists and engineers.

Air Force civilian scientists and engineers perform professional work in the fields of engineering, biological sciences, physical sciences, mathematics and statistics. There are approximately 7,600 civilian scientists and engineers in the Air Force; almost 4,000 of whom are in the Air Research and Development Command.

Eleven hundred of the 7,600 scientists are in missile work. Only a sprinkling of civilian scientists and engineers are employed outside of Air Research and Development Command, Air Materiel Command, and Military Air Transport Service. These are almost wholly in two categories: Installation engineers and operations analysts.

The relatively small number of civilian scientists in Air Force as compared to the rest of the Department of Defense is attributable to the fact that 95 percent of Air Force research and development work is performed by contract; less than 5 percent is in-house.

Our scientists and engineers constitute less than 3 percent of the total Air Force civilian work force. Our attitude surveys show that the desires and attitudes of scientists and engineers vary little from those of the total work force. The only two significant areas of difference between the expressed needs of scientists and engineers as opposed to those of the general employee population are shown by our attitude survey to be opportunity for professional growth and professional environment. Scientists and engineers in industry have similar attitudes.

MAJOR PROBLEMS

In maintaining a qualified scientific and engineering work force, the Air Force has three major overall problems:

1. We are currently not able to recruit civilian scientists and engineers in sufficient numbers and at various grade levels necessary.

2. At the GS–10 level—we have a chart for the information of you gentlemen—scientists and engineers are leaving the Air Force at twice the rate of nonscientists. The same situation prevails at grades below GS–10; however, the ratio is 1½ to 1 there.

CHART I

TABLE II.—*Salary schedule of the Classification Act—General schedule*

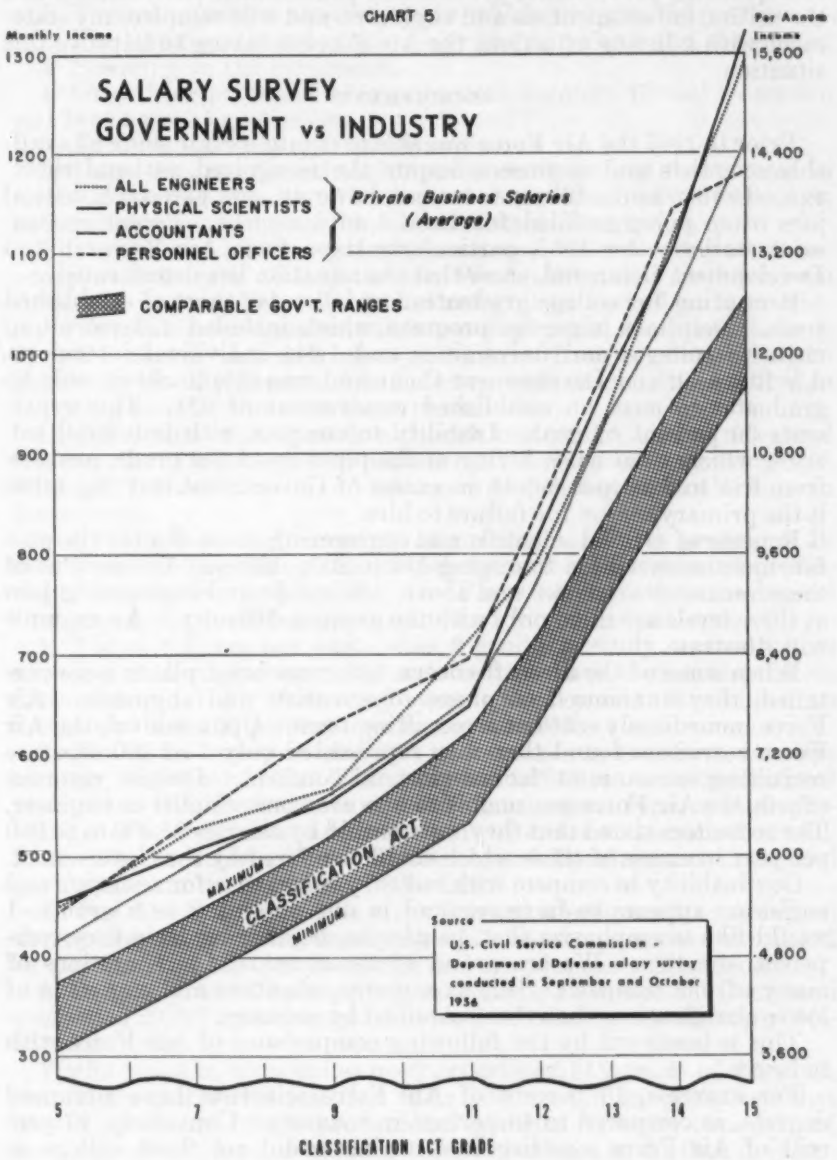
Grade	Basic pay rates							
	Minimum	Intermediate steps					Maximum	Step increase
GS–1	$2,690	$2,775	$2,860	$2,945	$3,030	$3,115	$3,200	$85
GS–2	2,960	3,045	3,130	3,215	3,300	3,385	3,470	
GS–3	3,175	3,260	3,345	3,430	3,515	3,600	3,685	
GS–4	3,415	3,500	3,585	3,670	3,755	3,840	3,925	
GS–5	3,670	3,805	3,940	4,075	4,210	4,345	4,480	135
GS–6	4,080	4,215	4,350	4,485	4,620	4,755	4,890	
GS–7	4,525	4,660	4,795	4,930	5,065	5,200	5,335	
GS–8	4,970	5,105	5,240	5,375	5,510	5,645	5,780	
GS–9	5,440	5,575	5,710	5,845	5,980	6,115	6,250	
GS–10	5,915	6,050	6,185	6,320	6,455	6,590	6,725	215
GS–11	6,390	6,605	6,820	7,035	7,250		7,465	
GS–12	7,570	7,785	8,000	8,215	8,430		8,645	
GS–13	8,990	9,205	9,420	9,635	9,850		10,065	
GS–14	10,320	10,535	10,750	10,965	11,180		11,395	270
GS–15	11,610	11,880	12,150	12,420			12,690	215
GS–16	12,900	13,115	13,330	13,545			13,760	
GS–17	13,975	14,190	14,405	14,620			14,835	
GS–18	16,000						16,000	

3. Air Force supervisors indicate that their better employees are leaving. Replacements filling vacancies, though basically qualified, have lower qualifications than those lost.

THE MAJOR CAUSES

Our present recruiting and retention problems can be largely attributed to the fact that over the years the gap between industrial salaries and Air Force has been widening. Almost 70 percent of our scientists in grades GS–11 and above leave because of pay. Maximum Classification Act salaries were 15 to 20 percent below salaries

CHART 5



for comparable work in industry in October 1956; chart II indications are that industrial salaries have risen approximately 5 percent per year since that time.

Further, the Air Force cannot match allowances offered by industry such as payment of travel expense for interview, transportation to first-duty station, and relocation allowances. In addition, our scientists and engineers feel that the professional environment and the opportunities for professional growth do not equal those of industry.

I shall now attempt to describe the current situation as regards recruitments, professional growth and professional environment and the utilization of scientists and engineers, and will complete my statement with a listing of actions the Air Force is taking to improve this situation.

RECRUITMENT

Prior to 1957 the Air Force was able to obtain its fair share of available scientists and engineers despite the recognized national shortage. Lead time in filling vacancies, however, was excessive, critical jobs often going unfilled for from 4 to 6 months. Recent recruitment statistics for 1957, particularly those from Air Research and Development Command, show that the situation has deteriorated.

Recruiting for college graduates has fallen far short of established goals. Despite a vigorous program which included 222 recruiting visits to colleges and universities and 1,644 individual interviews, Air Research and Development Command was able to obtain only 85 graduates to meet an established requirement of 234. This represents 36 percent of goal. Inability to compete with industrial salaries, which, even when hiring at the top step of the grade, are now from $85 to $200 per month in excess of Government starting rates, is the primary reason for failure to hire.

Reports of critical scientific and engineering vacancies for the past few months have been averaging 150 to 200. Seventy-five percent of these vacancies are GS–9 and above. Scientific and engineering jobs at these levels are filled only with the greatest difficulty. An example will illustrate.

When some of the aircraft contracts in west coast plants were curtailed, they announced surpluses of scientists and engineers. Air Force immediately sent out a recruiting team. Upon arrival, the Air Force recruiters found that they represented only 1 of 400 separate recruiting teams, most from industrial concerns. Despite vigorous efforts, the Air Force was unable to hire even one scientist or engineer. The recruiters stated that they were outbid by salaries $3,000 to $4,000 per year in excess of those which could be offered by the Government.

Our inability to compete with industry salarywise for scientists and engineers appears to have resulted in our obtaining as a group—I would like to emphasize that, gentlemen, because we have very competent scientists. We are proud of the outstanding reputations of many of our scientists. But as a group, scientists and engineers of lower qualifications than those obtained by industry.

This is borne out by the following comparisons of Air Force with industry.

For example, 16 percent of Air Force scientists have advanced degrees, as compared to 48 percent in industry. Conversely, 27 percent of Air Force scientists and engineers did not finish college as

compared to only 6 percent in industry. Supervisors in the Air Force and in industry were queried on quality of replacements as compared to quality of employees leaving. Both groups indicated a loss in quality by the Air Force ratio was over twice that of industry.

PROFESSIONAL GROWTH AND ENVIRONMENT

As previously stated, opportunities for professional growth and environment are particularly important to scientists and engineers. They look at professional growth and environment in terms of the following:

1. The management atmosphere in which the scientist works.
2. Prestige through recognition—by the Air Force and the public.
3. Standing in the profession.
4. Growth or professional development through formal education and broad work experiences.
5. Excellence of physical facilities.

Industry has recognized the importance of each of these items in terms of keeping up with technological changes, and of the impact on both recruitment and retention of scientists and engineers.

The Air Force also recognizes the necessity to actively pursue improvements in each of these areas. We consider that we have been successful in providing awards and recognition as well as in providing a favorable management climate and physical facilities, items 1, 2, and 5 above. Attitude survey responses from scientists and engineers in the Air Force and in industry were essentially identical in reflecting satisfaction with these items.

In connection with item 4, although our programs for advanced training in management and professional development are being emphasized, both employees and managers feel that more can be done in these areas.

Following is a brief summary of current Air Force programs directed toward improving the competence and effectiveness of professional employees, keeping the Air Force abreast of technological changes, and providing opportunities for professional growth:

1. The Air Force has established 9 graduate study centers for its scientists and engineers; 2,198 man-courses have been scheduled at these centers for Air Force employees in fiscal year 1958. This is an increase of about 21 percent over fiscal year 1957.

2. The Air Force provided 526 man-courses in executive development in fiscal year 1957. This contrasts to 240 man-courses in fiscal year 1956. While these courses are management type, a high percentage of scientists and administrators of scientific personnel attend. Forty-nine executives in Air Research and Development Command participated in the fiscal year 1957 courses.

3. The Air Force has sent a great many employees to specialized short-college courses this fiscal year—561 man-courses were completed by personnel of the Air Research and Development Command.

4. In fiscal year 1957 also, Air Research and Development Command completed 29,227 man-courses of in-service training, representing 693,251 man-hours.

With respect to broadening work experience, 81 percent of the scientists in the Air Force feel that their jobs are not so specialized that it will handicap future professional growth. Twenty-two percent have approved plans to broaden their experience in further develop-

ment. The latter figure compares favorably to a figure of 18 percent in other Government agencies and 20 percent in industry.

With respect to item 3 above, to the extent that budgetary and mission requirements permit, the Air Force has encouraged participation in meetings of professional societies, and has decentralized authority to approve travel to such meetings. Air Force scientists feel that policy on discussion of accomplishments at such meetings is liberal. They are also encouraged to publish articles in professional journals.

UTILIZATION

Utilization is making the best use of the personnel available to the Air Force. The results of the attitude survey and the turnover studies indicate that:

1. Scientists and engineers in Air Force and industry feel the same about how their employers are utilizing their skills. Forty-eight percent of the Air Force scientists and engineers, and 54 percent of industrial scientists and engineers feel that their jobs require their full skill.

2. Sixty-four percent of Air Force scientists would like to spend more time on technical duties as opposed to administrative and other nontechnical duties, although they have said that only about 10 percent of their work can be done by technicians and administrative personnel.

3. Ninety-one percent of the college graduates in the Air Force in engineering and scientific positions are in jobs related to their academic training.

4. Only 1 percent of the scientists who resigned in 1956 indicated they left because of their skills not being fully utilized.

ACTION TO IMPROVE PRESENT PROGRAMS

These are the actions that Air Force is taking:

1. It is actively supporting the administration's salary recommendations.

2. It is actively supporting a legislative request for more supergrade and Public Law 1028 positions in order to relieve salary compression at top levels.

3. It is accelerating classification standards development for scientific and engineering positions.

4. It is participating in fellowship programs.

5. It is encouraging greater attendance at professional and scientific meetings.

6. It is providing each year more advanced professional, technical, and executive training.

7. It is continuing to emphasize participation by scientists and engineers in the incentive and awards program. Scientists and engineers in 1956 received 30 percent of all decorations for exceptional service and in Air Research and Development Command, 56 percent of all awards were given to scientists and engineers.

8. It is developing program materials for use by supervisors in obtaining maximum utilization.

9. It is developing informational materials directed to supervisors to emphasize the need for maximum interchange of ideas between employees and management on utilization.

Thank you for this opportunity to appear. I shall be happy to answer any questions you might have.

Mr. HÉBERT. Thank you very much, sir.

Mr. COURTNEY. Just one question here. I notice, Mr. Watts, that the rate of advanced training taken by your Government people seems to be pretty close with the experience of industry. But I also note that the quality or standard of your input is less than that of industry.

Mr. WATTS. Right.

Mr. COURTNEY. That is the only question I had.

Mr. HARDY. You speak about the disparity in salaries as a basis for some of your recruiting difficulties.

You say that the Air Force recruiters are outbid by salaries three to four thousand dollars per year in excess of those offered by the Government.

(Mr. Watts nods.)

Mr. HARDY. Where is your principal competition coming from? Does it come from the aircraft industry?

Mr. WATTS. I was trying to recall if we had any specific study in this area. I don't believe we have, sir.

But it is my impression that the present competition for scientists and engineers is pretty diverse. We find that the aircraft industry, general industrial concerns with research and development programs—I would not think it would be confined to the aircraft industry, sir, even though that might be one of the largest users.

Mr. HARDY. The reason I raised the question is this: I am wondering if the Air Force in its procurement policy with the aircraft industry isn't creating a substantial part of its own problem.

Mr. WATTS. I think that a part of the competition is from people having Air Force contracts. If I may make one other observation——

Mr. HARDY. Yes.

Mr. WATTS. We find in this area that our contractors tend to be competitive with other industry.

Mr. HARDY. Have you also found that your contractors are stockpiling engineers?

Mr. WATTS. I have no information on this, sir.

Mr. HARDY. You made studies along every other line. It looks to me like maybe you would find out something along that line.

Mr. WATTS. Well, primarily the statistics we have given have been studies of our own scientists and studies made in certain corporations using the same approaches. I have not studied, sir, that aspect of the question.

Mr. HARDY. Now, this question of pay and the competition that you have and your lack of success in the colleges bothers me a little, in the light of the testimony which Mr. Cordiner gave the other day before the committee considering the military-pay bill. They had pretty low rates of pay for junior officers—second lieutenants—that are coming out of school. And he went on to say that the pay of a

second lieutenant, an engineering graduate, was comparable to what he could earn in industry.

Now, when we come along here and get this kind of testimony from you, it seems to me to be in direct conflict with the testimony Mr. Cordiner gave the committee.

Mr. WATTS. I am not familiar with the testimony that Mr. Cordiner gave, but I have here before me some statistics issued by the American Management Association for 1957: rates paid to college graduates in various occupations and disciplines. This data was collected as of July 1957.

It shows median rates being offered by industry, for mechanical-engineer graduates from college, as $5,500. This would compare—well, similar information or other information as the basis for my statements is given in that chart. But this would compare with the much lower entrance rates we are able to pay under our Classification Act, even when we use the top step rate.

CHART III

TABLE III.—*Professional starting salaries—1956*

Degree or profession	Information source	Industry	Government	Difference
Bacher of science engineer	NACA [1]	$5,200	$4,480	$720
Do	CPP [2]	5,200	4,480	720
Do	AMA [3]	5,300	4,480	820
Engineer	Endicott [4]	4,980	4,480	500
Bachelor of science physicist	NACA	5,190	4,480	710
Bachelor of science chemist	NACA	5,020	4,480	540
Do	CPP	4,940	4,480	460
Bachelor of arts or bachelor of science mathematician	NACA	4,950	4,480	470
Bachelor of arts or bachelor of science business administration.	CPP	4,400	3,670	730
Accounting	Endicott	4,470	3,670	800
General business trainee	do	4,360	3,670	690

[1] Derived from National Advisory Committee for Aeronautics' 1956 survey of 74 colleges and universities.
[2] Derived from Colgate-Palmolive Co. 1956 survey of 26 colleges and universities.
[3] Derived from American Management Association 1956, report on Administrative and Technical Position Surveys.
[4] Derived from 11th Annual Report on Trends in the Employment of College and University Graduates in Business and Industry, 1957, by Frank S. Endicott, director of placement, Northwestern University.

Mr. HARDY. What is the annual pay—these are annual figures you have up there. What is the annual pay of a second lieutenant in the Air Force? I am trying to make a comparison with what Mr. Cordiner brought out the other day.

Mr. KITCHIN. What year figures are these? I can't read them.

Mr. WATTS. 1956.

Mr. KITCHIN. You have more up-to-date statistical information?

Mr. WATTS. Yes; we have just obtained this from the American Management Association, 1957, for technical employees—the median rates they pay to college graduates and to nontechnical.

If you gentlemen would like, we would be happy to enter this in the record here.

(1957 information inserted below:)

CHART IV

College graduates, American Management Association, 1957

[Data from July 1957]

	Median
TECHNICAL	
Mechanical engineer	$5,500
Chemical and metallurgical engineer	5,500
Aeronautical engineer	5,600
Civil engineer	5,600
Industrial engineer	5,500
Electrical, electronics engineer	5,700
Nuclear engineer	5,800
Ceramics engineer	5,300
Safety engineer	5,400
Chemist	5,400
Mathematician	5,700
Physicist	5,700
NONTECHNICAL	
Accountant	5,100
Auditor	5,200
Systems and procedures analyst	5,700
Economist	5,100
Job analyst	5,000

Mr. HARDY. The thing that is bothering me here, Mr. Watts: Another place in your statement you talk about your recruitment difficulties and you say "The inability to compete with industrial salaries, which, even when hiring at the top step of the grade, are now from $85 to $200 per month in excess of Government starting rates, is the primary reason for failure to hire."

Mr. WATTS. Yes, sir.

Mr. HARDY. Now, Mr. Cordiner says that the second lieutenant's earnings in the Military Establishment were comparable with what that man as an engineer could get in private employment. I wanted to understand whether the offering rates that the Air Force is offering for civilian employment are less than a second lieutenant's pay. That is why I asked that question.

Mr. HÉBERT. Yes.

Mr. WATTS. We will see if we can figure this out.

Our entry rate now is the top step rate of a GS–5, $4,480, sir. We are authorized by the Civil Service Commission to in-hire from the college graduate level.

Mr. HARDY. Of course, we don't have anybody with that low a rank in here now, so we can get that answered.

General CARMICHAEL. A long time ago.

Mr. HÉBERT. Are you ready to answer, General?

General CARMICHAEL. Starting second lieutenant without flying pay gets $4,372.56.

Mr. HÉBERT. What does that consist of, General?

General CARMICHAEL. I shall supply that information.

Mr. HÉBERT. You are considering the basic salary, General? Put his quarters allowance down.

General CARMICHAEL. No, sir, that includes his base pay. It includes his dependents' housing allowance, that is, quarters allowance.

Mr. HÉBERT. He has it in there?

General CARMICHAEL. And includes $47.88 allowance for subsistence.

(The following are pay charts above referred to:)

Pay scales, 2d lieutenant upon entry into active duty

2d lieutenant without dependents and without incentive pay:	
Base pay monthly	$222.30
Subsistence monthly	47.88
Quarters monthly	68.40
Per month	338.58
Annual pay	4,062.96
2d lieutenant with dependents and with incentive pay:	
Base pay monthly	222.30
Subsistence monthly	47.88
Quarters monthly	85.50
Incentive pay	100.00
Per month	455.68
Annual pay	5,468.16
2d lieutenant without dependents and with incentive pay:	
Base pay monthly	222.30
Subsistence monthly	47.08
Quarters monthly	68.40
Incentive pay	100.00
Per month	437.78
Annual pay	5,253.36
2d lieutenant with dependents and without flying pay:	
Base pay monthly	222.30
Subsistence monthly	47.88
Quarters monthly	85.50
Per month	355.68
Annual pay	4,268.16

Mr. HARDY. Mr. Cordiner's observations, then, don't conform to the Air Force experience.

Mr. KITCHIN. But if I understand correctly now, there is this $4,480 that you start the civilian.

Mr. WATTS. That is right, sir.

Mr. KITCHIN. And a second lieutenant makes $4,372.56, or approximately $108 you are able to pay your civilian over and above what the second lieutenant gets in the military.

Mr. WATTS. On those two figures; yes, sir.

Mr. HARDY. And Mr. Cordiner's testimony was that the second lieutenant was making just as much in the military as he could make in private industry.

Mr. WATTS. Well, I wouldn't know what information Mr. Cordiner had.

Mr. HARDY. I am not asking you to comment on that.

Mr. HÉBERT. No.

Mr. WATTS. I would draw your attention, Mr. Hardy, to this data. This was collected—the first money column is the industrial rate for a bachelor of science engineer. The second is the Government rate. The third is the advantage industry in 1956 had over a Federal agency.

For a bachelor of science engineer, the National Advisory Committee for Aeronautics made a survey of 75 colleges and universities and came up with a finding that industry had a $720 advantage over a Federal agency in the recruiting at college graduation of a bachelor of science engineer.

The Colgate-Palmolive-Peet survey in 1956, of 26 colleges and universities, indicated that the industrial employer had a $720 advantage.

Similarly, down the line, sir.

Mr. HARDY. Well, I am sure that you are having your problems. But I confess that I get a little bit—I find a little difficulty in understanding the different presentations that are made to serve different purposes.

Mr. WATTS. Well——

Mr. HARDY. That is what bothered me a little bit on that.

Now, on page 5 of your statement you list a number of points, that your civilian employees, that is, engineers, as I understand that list, are stressed as being obstacles to governmental employment.

Is that what they are supposed to represent?

Mr. WATTS. These represent five items which appear to be of most concern or interest to the scientific and engineering employee.

This list was fairly common on the responses made by scientists and engineers in the Air Force and in industry, sir.

Mr. HARDY. Well, the first one that you have is the management atmosphere.

Mr. WATTS. That is right, sir.

Mr. HARDY. So the civilian engineers and scientists object to the management atmosphere that the Air Force presents; is that what you mean?

Mr. WATTS. No, sir. This was an item of great concern to them. Their responses on this item, as I point out in the following paragraph, indicated that, as a group, they were favorable—they responded favorably to the management atmosphere in which they work, sir. Similarly, they responded favorably to item 2. And they responded favorably to item 5. These were very close to the responses given by engineers and scientists working in industrial concerns.

In connection with the item 4 there, growth and professional development through formal education and broad work experience, they felt that more could be done in the Air Force.

Mr. HARDY. Maybe I misunderstood these points. I thought these were points of consideration that seemed to affect the selection of employment by an individual, as to whether it would be the Air Force or the Government.

Mr. WATTS. Yes.

Mr. HARDY. And if a scientist's first consideration is the question of management atmosphere, it looks like some of your difficulty in recruiting must be attributable to the management atmosphere within the Air Force.

Mr. WATTS. Yes, sir.

Mr. HARDY. Of course, you don't say whether that is a management atmosphere from the civilian side or the military side.

Mr. WATTS. Yes.

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Mr. HARDY. And I was wondering whether it is a matter of governmental redtape of what the trouble is that is involved in that particular point.

Mr. WATTS. I see, sir. Primarily, these are the five items that our scientists stressed as items of importance to them. They also told us, on the survey that we made, that we were doing a pretty good job on the first, second, and fifth. However, they felt we could definitely be doing better on the fourth item—on the 1, 2, and fifth, and we could be doing better on the third and fourth items for them .

Mr. HARDY. Now, on page 6, you refer to opportunities for professional growth——

Mr. WATTS. Yes, sir.

Mr. HARDY (continuing). Which the Air Force has provided. You say, "Established nine graduate study centers."

Mr. WATTS. Yes, sir.

Mr. HARDY. Now, are they Air Force conducted?

Mr. WATTS. In these centers, Mr. Congressman, we reach a contract with a nearby university or college. For our Wright Air Development Center at Dayton, Ohio, for example, we have a contract with the Ohio State University to provide this training needed by our scientists and engineers.

The Ohio State University sends their faculty members to our base, and these courses there are conducted largely at Wright Air Development Center, by faculty members supplied by Ohio State University on the basis of the annual contract we negotiate with them.

Similarly, the other eight—if you would like a brief description, I have the information here, sir.

Mr. HARDY. No. I was just trying to understand how you arrived at it.

Mr. WATTS. I see.

Mr. HARDY. And I was wondering, as a result of these valued study courses, your civilians who took these courses stayed with you long enough. Was the rate of turnover reduced?

Mr. WATTS. We find that the civilians who take these courses stay with us longer as a group than the civilians who do not take these courses. We have statistics which would indicate that. Here are some, sir. Graduate study center attrition rates. For the total of the Air Research and Development Command program, of the scientists and engineers who participated in these programs, the attrition rate was 16.88 percent, as compared with an attrition rate of 22.95 percent for the scientists and engineers who had not attended such courses.

Mr. HARDY. And these are the graduate students only, or is this the total?

Mr. WATTS. This is the graduate study program, sir.

Mr. HARDY. And does that relate only to the people who would have been eligible for graduate studies?

Mr. WATTS. That is right; for the total population of scientists and engineers who would be eligible, the group who went and who did not.

Mr. HARDY. They would all be eligible, I would presume, over a period of time?

Mr. WATTS. Yes, sir. Also, these people will; I might say we do require, any time we have contract training, the individual to give

us a certificate; that is, a promise that he will spend three times the length of service with us that we give him in putting him through a contract course, sir. Hence, we feel that we do get quite a strong tie on the individual through this form of obligation.

Mr. HARDY. Well, now, these graduate-study courses that you are talking about here; do they entail off-time work only on the part of the participants, or are they conducted during normal work hours?

Mr. WATTS. The graduate center training programs are conducted during work hours, sir, but conducted on the base. Hence, the individual would be at his regular job that part of the day he is not in one of these courses.

Mr. HARDY. So that he had paid for the time that he is attending these courses?

Mr. WATTS. I don't quite understand your question, Mr. Hardy.

Mr. HARDY. I mean that he attends these courses during his regular work hours?

Mr. WATTS. This is right, sir. He gets paid for that in the graduate center training program.

Mr. HARDY. Does that apply also to your No. 2 group, in executive development?

Mr. WATTS. Yes, sir. The difference there is that these courses are usually off the base. We might send selected scientists, a selected scientist who is a manager of a laboratory to one of the American Management Association's executive development courses. Here he would go to their course in New York City. It would be, I believe, a 2- or 3-week course. He would be in full business status and pay for the time that he was at that course, sir.

Mr. HARDY. Is that different, then, from your group No. 3, in which you have your short courses?

Mr. WATTS. It is not different in time. It is different in subject matter. These courses in No. 3, Mr. Hardy, are specialized courses, usually in some new fields of scientific research and development. These are short, specialized courses, largely scientific and engineering, to keep our scientists up to date with new developments in the field.

Mr. HARDY. Have you computed the value of this additional training which is offered to your personnel in making comparisons of what you are actually paying them, and what industry pays?

Mr. WATTS. No; I can't say we have. I think that an indirect answer to your question might be this, that industry does the same thing.

Mr. HARDY. In a lot of cases, I am sure.

Mr. WATTS. Yes, sir; and it would appear, from what our scientists tell us, they think industry does more of this type of training than we do, sir.

Mr. HARDY. I am not suggesting that it isn't a good idea to do it.

Mr. WATTS. Yes, sir.

Mr. HARDY. But I am trying to understand what you are accomplishing, and what it is costing you.

Mr. WATTS. Well, sir, I have here some statistics on cost if you would like those, sir.

Mr. KITCHIN. If the gentleman would yield right in this particular instance, I would like to get the cost figures in connection with your

problem. There is a savings in attrition of approximately 3 to 3½ percent.

Mr. WATTS. That is right.

Mr. KITCHIN. Of those who take these courses as against those who don't. Have you any monetary statistics as to what that 3 percent in savings in attrition has actually cost you?

Mr. WATTS. No, sir; I have not. An estimate could be prepared. It would have a lot of assumptions for the basis of it, though.

Mr. KITCHIN. I think it would be well, Mr. Chairman, to have that in the record, to see whether or not that savings in attrition of 3 percent is not costing a heck of a lot of money, or whether or not it is worth the time consumed to do it.

(The information requested is as follows:)

The cost of graduate center training to the Air Force for fiscal years 1954 through 1956 was $389,139. For this same period there were 4,949 nonparticipants, of which 1,136 resigned; there were 1,658 participants, 280 of whom resigned. Had the turnover rate for participants been the same as that of nonparticipants, 381 would have left, or a difference of 101.

If graduate center training were viewed in terms of retention alone (rather than for all of the truly productive benefits derived from training for which savings can be proven) it could be said that it cost the Air Force $389,139 to retain those 101 employees.

The Air Force has no specific figures on cost of turnover. Therefore, we can but refer to the Cordiner Committee report which in turn quoted Industrial Relations Counselors, Inc., of New York, N. Y., as follows:

"The cost of engineering turnover is staggering. While turnover costs at the rank-and-file level (clerical or production workers) range between $300 to $500, the cost of recruiting, training, and (after a fair trial) of losing an engineer amounts to between $5,000 to $20,000. The losses to a company in terms of the individual engineer's creative potential are incalculable."

If the minimum figure of $5,000 were used, the retention of the 101 employees represents a total savings in turnover costs to the Air Force of $505,000. If this amount were offset by the total cost of graduate center training, the net savings would be $115,861 for the 3-year period.

It should be noted, as indicated above, that the value of training is not in retention alone but is in keeping employees abreast of rapid technological changes, improving the level of employee performance, and meeting the needs for acquisition of knowledges not otherwise available to the Air Force.

Mr. HARDY. I think that would be a very helpful figure to have, if we can get it. I think also that we ought to be advised as to whether when these individuals complete one of these courses they are automatically eligible for an increase in grade.

Mr. WATTS. Of course, to be eligible for the increase in grade, we now have the Whitten amendment requirements of a year's service in grade. If one of these students had that year behind him, he would be eligible for a grade promotion in the event there was a promotional opportunity at his laboratory. That would be the only basic requirement, sir, whether or not he had served the 1 year in the lower grade.

Mr. COURTNEY. What about the number of applicants for these slots of which you speak? You gave us an attrition rate of 16 percent. Can you relate that to numbers of persons?

Mr. WATTS. You mean in terms of applications we have?

Mr. COURTNEY. Yes; that is right.

Mr. WATTS. We have practically no voluntary applications for engineering and scientist vacancies in the Air Force. We have to go out, sir, and recruit very vigorously to locate people.

Mr. COURTNEY. Well, I wasn't thinking about that quite as much as I was thinking of the number of applicants for these study opportunities within the Air Force.

Mr. WATTS. I see. The determination as to who participates in these training programs for scientists and engineers is a management determination. The chief of a research section in one of our laboratories, perhaps the Wright Air Development Center at Dayton, will study the research projects or the missions being carried out in his division. He will then determine whether or not any of the scientists and engineers in that staff, that is on his staff, need additional training or courses. Actually, when we go—when our representatives go to Ohio State University each year, they go with a list of courses which the supervisors, that is, which management in our laboratories, have determined will improve the proficiency and competence of the engineers and scientists working at the laboratory.

Mr. KITCHIN. On the project in which they are engaged?

Mr. WATTS. On the work in which they are engaged.

Mr. HARDY. Also I would presume he is able to pick out the people that he decides to promote to fill out a job that is coming up?

Mr. WATTS. Yes, sir.

Mr. HARDY. To qualify for the promotion?

Mr. WATTS. That is right.

Mr. HARDY. The Air Force pays for that in order to have somebody that will have the experience and then will have the knowledge to fit into it?

Mr. WATTS. Yes, sir.

Mr. HARDY. That is a pretty good deal for the individual, if he happens to be selected?

Mr. WATTS. Yes.

Mr. KITCHIN. I would like to ask 2 or 3 questions.

Mr. WATTS. Yes, sir.

Mr. KITCHEN. First, let me compliment Mr. Watts on a very comprehensive statement he made here. You made a comment at the outset of your statement that a recognized national shortage in scientists and engineers exists.

Mr. WATTS. Yes.

Mr. KITCHIN. Is that quantity or quality or both?

Mr. WATTS. From my reading, sir, as to quantity it depends on which expert you read. Some of our experts maintain there is an overall quantitative shortage. Other studies, those made by Columbia University, for example, would indicate that perhaps there isn't. However, all of the experts I believe do agree that there is a very acute qualitative shortage. And, again, it is the quality of our scientists, sir, that concerns us more than the actual quantity.

Mr. HÉBERT. You mean our scientists—you mean American scientists or the scientists of the Air Force?

Mr. WATTS. Qualitatively, sir, in America an acute shortage of quality among all scientists in this country.

Mr. HÉBERT. You are the first witness that testified to that.

Mr. WATTS. Sir?

Mr. HÉBERT. You are the first witness that testified to that.

Mr. KITCHIN. I think it is to be assumed, Mr. Chairman, that we never have the quality that we are seeking to get.

Mr. WATTS. Yes.

Mr. KITCHIN. The standpoint of the increase in technology in the last 18 months to 3 years, I would say, makes it very apparent that we need more in the high echelon training than we have readily available at the present time.

Mr. WATTS. Yes.

Mr. KITCHIN. Now, on the basis of the statements you made, that there is probably one phase of thinking, sponsored by some groups, that say that there is, and some say there are not, insofar as quantity is concerned.

Mr. WATTS. Quantitatively.

Mr. KITCHIN. What has been your experience from your studies and your surveys with reference to the recruitment of those positions that you have to fill? Is there a dirth of scientific and engineering personnel?

Mr. WATTS. If I might answer—I can't answer "yes" or "no." I would like to give you a few qualified statements. I point out in my statement that prior to the current situation we had difficulty filling vacancies, but it was a matter of taking a bit longer time to fill vacancies. It wasn't a matter of being unable to fill them, sir. However, last fall we hit a situation for the first time where we have been unable to fill some 150 to 200 vacancies. Recurringly, it is more difficult to fill them.

Mr. KITCHIN. Is that occasioned by the lack of funds available or your program in which you're recruiting these, or is it the inadequate number of scientists to fill the jobs?

Mr. WATTS. This is the inability of our recruiters to find people they will offer the jobs to, sir.

Now, there is one bright spot we have noted in the last month or so—we made a telephone check with two of our largest laboratories—the Wright Air Developmental Center, and our laboratory up in New York State, this week. They have told us that the difficulty in filling these critical vacancies is as great as it has been. It is almost impossible to fill them. However, we are losing less people now. More people are staying. The loss of the scientist is somewhat lower than statistics I gave you, for the last couple of months. This might be attributed to the general economic situation at present. But, nevertheless, it has not helped us, the general situation, in filling these critical shortages, sir.

Mr. KITCHIN. I understand you said at the outset that only 5 percent of your research and development program is carried on within the Air Force.

Mr. WATTS. That is right, sir.

Mr. KITCHIN. How many in the top grade levels that are receiving at the present time the top salary in that 5 percent——

Mr. WATTS. Yes.

Mr. KITCHIN. How many individual scientists do you have in that group?

Mr. WATTS. You are referring to our Public Law 313, or 1028 scientists.

Under Public Law 313, or now, 1028, I am told, we have 35 authorized positions for scientists, at salary ranges between $12,500 and $19,000.

That is our highest paid group of scientists and engineers, sir.

Mr. HÉBERT. You say authorized. Do you have that many?

Mr. WATTS. At the present time, I believe our employment is approximately 32 of that 35, sir. Three vacancies, I believe. That is my last check on it.

Below that salary range, $12,500 to $19,000, I could, if you desire, give you the numbers and percentages of scientists and engineers in lower grades—15, 14, 13.

Mr. KITCHIN. That might be helpful. But I wasn't interested in that particular phase.

Mr. WATTS. I see.

Mr. KITCHIN. I want to develop this point. Of the 32 that you now have employed under the high salaries you can pay under the scales you have available now, do you have any information as to how many of those were educated in the United States, and how many educated outside the United States?

Mr. WATTS. I do not have that offhand, sir. We certainly could obtain and send it to you.

Mr. KITCHIN. Do you have a rough guess?

Mr. WATTS. Yes, sir.

It is my impression that the preponderant majority were trained and educated in the United States.

Mr. KITCHIN. The majority were.

Mr. WATTS. That is right, sir.

I can at the moment think—there may be none, but there may be a few, sir. But I am sure that the vast majority were trained, and educated in the United States.

Mr. KITCHIN. Then any statement to the effect that the top scientists, in at least the Air Forces have been educated in foreign universities, is just a myth.

Mr. WATTS. Generally, a myth, sir.

Mr. KITCHIN. Yes, sir.

Mr. WATTS. For that level.

Mr. KITCHIN. Now, getting back to the statement that you made about the experience in California, or on the west coast——

Mr. WATTS. Yes, sir.

Mr. KITCHIN. Do you have any statistics or any information to show how much of the competition came from the 95 percent of the contract units which are engaged in the research and development programs of the Air Force?

Mr. WATTS. No, sir, I don't, but I would assume that a good share of it did come from Air Force contractors who need scientists just like industry, other parts of our industry.

Mr. KITCHIN. So actually the failure to obtain these scientists didn't redound to your total disadvantage when your contractors are doing 95 percent of your research and development?

Mr. WATTS. That is right.

Mr. KITCHIN. Were obtaining some of these scientists that were available.

Mr. WATTS. Not at all, sir. Our contractors do a very vital part of our research and development, and my personal feeling is one of great personal happiness that they can pay rates competitive with the rest of industry.

Mr. HÉBERT. Who pays those rates?

Mr. WATTS. From the money coming to the contractor.

Mr. HÉBERT. Where do they get their money?

One hundred percent from the Government—to put you out of business.

Mr. HARDY. You are reimbursing them to pay their scientists that are competing with you, that you are trying to employ. You are paying them more money than you would pay them if you employed them direct?

Mr. WATTS. That is right, but I want to point out that they are only paying rates that are common to progressive American industry and they pay those rates to maintain their share of the quality to work on their contract.

Mr. HARDY. You are pretty sure of that?

Mr. WATTS. From the data I have seen, their rates are pretty close to those paid by other industries in the country, sir. I know of no cases where they are paying rates much higher than industry in general.

Mr. KITCHIN. But it gets back to the same thing, that in your general contractor relationship is where most of your attrition is absorbed?

Mr. WATTS. Yes.

Mr. KITCHIN. They pay the scientists more money to get him away from you, and then they include that in their cost contract to the Government, and actually we are paying them still and paying them a bigger salary.

Mr. WATTS. This is what happens.

Mr. HÉBERT. And their travel expense, too, Mr. Kitchin, from one place to another, which we are paying.

Mr. WATTS. This sometimes happens.

Mr. HARDY. Have you made any analysis to determine how many of the people that you are losing are actually going over to your contractors at a higher pay?

Mr. WATTS. No, I have not, sir.

Mr. KITCHIN. That would be interesting.

Mr. HÉBERT. We thank you, sir, and thank you, General, for having contributed your statements to the committee. This will conclude the testimony from the services in the area of scientists.

Mr. COURTNEY. We have a short statement, I think, from the Department of Defense, Mr. Chairman, which is not ready this afternoon.

Mr. HÉBERT. We will have to take them later—or this afternoon.

Mr. HESS. Can they give it now?

Mr. COURTNEY. No, sir; there is no one here.

Mr. HÉBERT. Thank you very much, gentlemen.

The committee will stand in recess, subject to call.

(At 4:05 p. m., the committee recessed, subject to call.)

REVIEW OF NATIONAL DEFENSE—PHASE 2

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SPECIAL SUBCOMMITTEE NO. 6,
Washington, D. C., Monday, March 31, 1958.

EXECUTIVE SESSION

The special subcommittee convened at 2 p. m., Hon. F. Edward Hébert (chairman of the subcommittee) presiding, with Mr. Hardy, Mr. Hess, and Mr. Wilson.

Mr. HÉBERT. The committee will be in order.

Mr. COURTNEY. Mr. Chairman, this resumes the consideration of the subject of the shortage of scientists and engineers, with a presentation on the part of Gus Lee, the staff director for manpower utilization of the Department of Defense.

We have heard, Mr. Chairman, from the three military departments, both civilian and military representatives, and this will be the conclusion of that portion of the study having to do with the relationship of the Department of Defense in this whole picture.

Mr. HÉBERT. Mr. Lee has not been sworn?

Mr. COURTNEY. Mr. Lee has not been sworn. Will you rise, please, Mr. Lee. This is a proceeding under House Resolution 67, and all witnesses have been sworn.

Mr. HÉBERT. You do solemnly swear that the testimony you will give before this subcommittee in the matters now under consideration will be the truth, the whole truth, and nothing but the truth, so help you God?

Mr. LEE. I do, sir.

Mr. HÉBERT. You may proceed.

STATEMENT OF MR. GUS LEE, STATE DIRECTOR FOR MANPOWER UTILIZATION, DEPARTMENT OF DEFENSE

Mr. LEE. Mr. Chairman, this brief statement covers defense requirements for scientists and engineers, actions, taken to lessen the impact of the military obligation on the supply of scientists and engineers; our educational programs for scientists and engineers; and actions to improve utilization. Defense has established positive programs in each of these areas.

Defense has four rather distinct requirements for personnel educated in the sciences and engineering.

First is a requirement for military personnel to perform military functions—the need for technical personnel to operate and maintain equipment in the operating forces—the wings, the fleet, the ground combat and combat support units in the field. In many of these jobs an engineering background is a desirable qualification.

Two of the requirements are largely for civilian personnel to perform nonmilitary functions. These are the civilian scientists and engineers who work in our research and development centers and manufacturing establishments. Defense employs about 43,000 civilian scientists and engineers, nearly half of whom are in research and development.

The fourth requirement is for career military officers normally at the rank of colonel or Navy captain, with sufficient technical background to manage research and development or industrial activities or to oversee the work of these activities from the bureau or technical service level.

For example, about 5,500 officers are assigned to research and development activities, almost half of them to such test centers as Edwards Air Force Base or Aberdeen Proving Ground.

An understanding of these requirements is necessary background to discussion of Defense actions regarding scientists and engineers.

ACTIONS TO LESSEN THE IMPACT OF THE MILITARY OBLIGATION ON THE SUPPLY OF SCIENTISTS AND ENGINEERS

Defense has supported constructive and practical programs to lessen the impact of the military obligation on the supply of scientists and engineers.

First, Defense fully supports the student deferment policies under Selective Service. At the present time, 145,000 students are deferred to complete their education. In addition, 34,000 persons with critical civilian occupations are deferred because they are employed in defense-supporting industries and research.

The 260,000 ROTC students enrolled in our colleges and universities are also deferred. These deferments serve to keep open our educational pipeline. Defense policy allows the ROTC graduate qualified in a critical occupation to delay his active duty long enough to obtain a master's degree in his specialty.

Many potential scientists and engineers enrolled in ROTC programs may elect 6 months active duty for training rather than 2 years. In the event it becomes necessary to meet active duty requirements by ordering ROTC officers to active duty for 2 years involuntarily, an officer trained in the sciences or engineering may be so ordered only if the service has a requirement for his critical civilian skill.

Mr. Chairman, this latter is a recent policy which we have put into effect just within the last 2 or 3 months.

Defense has acted to remove from the Ready Reserve those reservists who possess critical civilian skills which are not positively required by the services. These reservists are subject to recall only after mobilization upon determination by Selective Service that the individual's skills are more needed in the military than in the civilian economy. Selective Service records show that approximately 90,000 reservists have been screened to the Standby Reserve because they possessed critical civilian occupations. An estimated 40 percent of these were scientists and engineers.

In 1956 Defense initiated its critical skills program, under which qualified young scientists or engineers working in research or defense industry may discharge their military obligation by volunteering for

3 months of active duty training, with the remaining time spent in Reserve status.

About 5,100, of whom 3,400 are scientists and engineers, have been found qualified by this program, given their basic training, and promptly returned to the civilian economy after 3 months in order to minimize their loss to defense-supporting industries.

ACTIONS TO ADD TO THE RESOURCES OF SCIENTISTS AND ENGINEERS BY EDUCATION AND TRAINING

The increasing complexity of modern weapons systems and communications has made it desirable for Defense to encourage and assist officers to continue their formal education to the college degree or higher.

Approximately one half of all the officers on active duty at the present time have a college degree (an estimated 164,000). Of these, about 15 percent are qualified in the natural sciences and engineering, but less than 2 percent have a master's or doctor's degree in these fields. At least a college degree in science or engineering is required for officers who are assigned to supervisory-type positions in the research and development field. The need for officers with a technical background in the sciences or engineering is not, however, confined to the research and development field. Such fields as intelligence, combat engineers, air defense, maintenance and production and procurement have many jobs for which a technical background in engineering is desirable.

Service programs to improve the quality and increase the supply of scientific and technically qualified officers include: regular tours of duty at civilian universities, in-service education, tuition assistance programs, and off-duty study.

An education program at civilian universities has been established at the graduate level: (1) to provide qualified officers for duty in the scientific and engineering fields in which a graduate degree is required and (2) to improve the educational level of officers serving in these special ties. Under this program, the services contract for specified education with selected civilian universities.

Courses include—among others—civil engineering, nuclear physics, applied mathematics, ordnance engineering, fuel technology, seismology and metallurgy. From fiscal year 1946 to fiscal year 1958, the program produced 7,500 officers with a master's degree or higher in the scientific and engineering fields. There are now approximately 1,250 officers doing graduate work at civilian universities such as MIT, California Tech., University of Michigan, Iowa State, Lehigh, University of Maryland, Stanford, and so forth.

Principal in-service graduate education programs are conducted by the Air Force Institute of Technology (AFIT) Resident College at Wright-Patterson Air Force Base, and the Naval Postgraduate School at Monterey. The program at AFIT, designed primarily for graduate engineering work, includes courses in nuclear, aeronautical, electrical and ballistics engineering, as well as specialized courses in management. It has an average annual enrollment of 270 students. It may be of interest to you that the Institute is preparing to conduct a graduate astronautics program starting in September 1958 with an enrollment of 40 students.

The Naval Postgraduate School, with an enrollment of 85 in the physical sciences and 448 in engineering for fiscal year 1958, is expanding its science program for the coming year to 215 students and its engineering course to 527.

Expansions in the former program will include advanced science, ordnance, and aerology. The latter program will install a new general engineering curriculum for the fleet officers.

Under the tuition assistance program, students receive tuition assistance for courses taken off-study, or are placed on temporary duty at a college or university for a final semester to complete college degree requirements.

Mr. COURTNEY. Are these military personnel or civilians?

Mr. LEE. These are all military personnel, sir.

There are similar programs for civilians, but this particular program, tuition assistance program, is for military personnel.

Under this program, the service pays up to three-fourths (not to exceed $7.50 per semester-hour) of the tuition costs for each course. Subsidized courses, generally, are restricted to those leading to a baccalaureate degree or, at the graduate level, to the fields of mathematics, physical sciences, international relations and management. Army figures show that, from 1948 to date, 12,293 degrees have been earned, and 176,540 single college courses have been completed, by its officers.

Current Army enrollment in college courses is 17,149. Of that number 21 percent are in mathematics and the physical sciences.

Under the Air Force program, Bootstrap, approximately 6,000 officer students participate annually in off-duty study with tuition aid. Final-semester, temporary-duty participants in the tuition-assistance program are limited to not more than 200 at any one time in the Air Force. Approximately 3,500 degrees have been earned by Air Force officers during their off-duty time, of which 8 percent have been in the scientific and engineering fields.

Officers and enlisted personnel of all services participate in the Armed Forces Institute program, monitored by the Department of Defense Armed Forces Information and Education Service, and providing a wide variety of voluntary off-duty educational programs for military personnel.

This program is carried on through correspondence and self-teaching courses up to the 2-year college level. In addition to the foregoing, the Armed Forces have developed extensive programs for the training of enlisted personnel, ranging from formal school training to on-the-job training. New weapons and technical equipment have increased the skill requirements for specific jobs, as well as the number of skilled jobs. In fiscal year 1957, it was estimated that about 250,000 persons were trained in technical and mechanical skills in service schools, and this is primarily at the enlisted level I am discussing here. The length of the courses varied with the subject matter from a few months to a year.

Recognizing the need for advanced training for certain enlisted personnel who maintain, service, and operate the more complex equipment of its ships and aircraft, the Navy inaugurated its enlisted advanced school program in 1956. Under this program, selected enlisted personnel of proven technical skill are sent to engineering colleges where they study for 2 years, return to the operating forces for 2 years, and then return to college for the final 2 years of engineer-

ing education leading to a baccalaureate degree. These men are allowed to compete for officer status along with their contemporaries. There are 90 students presently enrolled in Purdue University and 47 students in the University of Washington under this program. The planned input is 100 men per year.

In January 1958, in recogition of the increased emphasis on science, the Navy inaugurated its enlisted scientific education program. Under this program, selected enlisted personnel will be enrolled in civilian universities to pursue regular college catalog courses in scientific fields. Upon graduation they will be offered a commission if otherwise qualified. They will be required to serve 4 years of obligated service in return for their 4 years' college training. About 200 students will enter colleges in September 1958. It is planned ultimately to enter 400–500 students a year into this program.

One of our serious problems is that retention of Reserve Officers in the research and development field is considerably below average. A recent Air Force survey, for example, shows that only 7 percent of the officers in this field planned to continue beyond their obligated tour. As a result of this low retention, there is a serious gap of technically trained officers in the lower ranks of the officer corps.

Defense also supports the further education of civilian scientists and engineers through organized graduate program at universities and technical institutes, as well as short, specialized courses to keep such personnel current in their respective fields. As many as 20 percent of the Department's civilian specialists are afforded an opportunity for advanced study in their respective fields. And this figure would refer primarily to short courses, of maybe 1 or 2 months, which they might take related to their job needs.

Defense has recently enlarged its existing programs for the cooperative education of promising young civilian personnel, as a future source of qualified scientists and engineers. The military departments operate these programs under the principle of alternate work-study periods for each candidate, with students being hired in pairs. One works at a military installation while the other is at school. They change places at the end of each college quarter. Current enrollment under this program is 1,860.

ACTIONS TO IMPROVE MANAGEMENT AND UTILIZATION OF SCIENTISTS AND ENGINEERS

An important way to stretch our supply of scientists and engineers is to make the best possible use of those we already have. Defense has taken a variety of actions to improve the utilization of the scientists and engineers, both military and civilian, which it already possesses. Each service has now created research and development career fields for their officers qualified in the sciences and engineering. Moreover, new regulations permit more stabilized assignments of qualified officers in these career fields. Tours of duty may be 3 or more years.

Since 1949, the Army has operated its scientific and professional personnel program for enlisted personnel. Draftees qualified in the sciences and engineering are identified as they enter military service and are assigned to 1 of 5,000 designated positions in the Army's research and development laboratories or test centers, which require the assignment of professionally qualified personnel for effective per-

formance of the duties involved. Their utilization in these positions is individually monitored by The Adjutant General in Washington, D. C., to insure effective usage of their skills.

The military departments, under Department of Defense guidance, are stepping up their programs for improving the management and utilization of their civilian scientists and engineers.

The military departments conducted extensive surveys of the attitudes of approximately 16,000 of their scientists and engineers during fiscal year 1957. These surveys revealed several areas where remedial action by the laboratory or service would improve utilization, raise morale, increase retention, and improve productivity of our civilian scientists and engineers.

Action has been taken to improve the physical facilities in which scientists and engineers perform research and development duties. We believe that a better working climate will permit better utilization of the talents of our scientists and engineers and encourage creative thinking and maximize their research and development production. The Secretary of Defense, on February 1, 1957, directed that projects to improve the physical working conditions for technical personnel be given appropriate priority in construction and installation.

The military departments have taken action to relieve their scientists and engineers of administrative details and nonprofessional work. Such work is assigned to an administrative assistant or "Man Friday," who works with a team of scientists and engineers, doing the detailed work which would otherwise consume much of their technical time.

In conclusion, Mr. Chairman, defense is vitally concerned in improving the supply, the education and training, and the utilization of scientists and engineers. This subject is a matter of priority attention at all levels of management.

Mr. HÉBERT. Thank you very much, Mr. Lee.

Mr. COURTNEY. On page 8 of your presentation you have referred to what you say is the Adjutant General's monitoring of draftees to insure effective use of their skills. Now, is that carried out, Mr. Lee?

Mr. LEE. These draftees who have a bachelor's or master's degree in the sciences or engineering or in some cases business are identified at the basic training center where they are sent to and are processed——

Mr. COURTNEY. How and by whom are they identified?

Mr. LEE. In this case, this would be a matter of the personnel and assignment and classification people looking at their records, and if it appears from their records that they do have a bachelor's or a master's degree in these educational fields they automatically qualify for this program.

Mr. COURTNEY. Well, who in fact conducts this investigation, Mr. Lee.

Mr. LEE. This would really involve a screening of the records and personal interview of the draftee by a classification specialist to obtain evidence of qualification for the program.

Mr. COURTNEY. Well, who would make the records? What kind of personnel makes these records?

Mr. LEE. Well, the man himself will fill out his records. This is the personnel form.

Mr. COURTNEY. All right, let's take a specific case. Assuming a graduate of an architectural school reported that after having spent 5 years and gotten his 2 degrees in architecture having won the Beaux Arts prize for design—were to come up before one of these employees that you speak of for assignment. What, in your opinion, in the process that you have indicated, would be a suitable use to be made of his talents? And how would you go about to discern it?

Mr. LEE. In the case of a job such as architecture, for which we do not have by and large in the Army a military requirement in the sense that our need for architects is filled largely by civilians—that is we don't have architects in military units, so we don't need in the United States a rotation basis for architects by and large—in that case, or in that kind of a case he would not be used in a job which required his architectural knowledge.

Mr. COURTNEY. I wouldn't assume the Army would have architects, as a matter of necessity.

But doesn't he have other talents in which he has been trained in order to be an architect?

Mr. LEE. Yes.

Mr. COURTNEY. What are they?

Mr. LEE. First, let me say this, now for scientists and engineers——

Mr. COURTNEY Well, let me shorten it up. The first thing he would have to know would be draftsmanship, wouldn't he?

Mr. LEE. Yes.

Mr. COURTNEY. Is that a useful talent in the United States Army?

Mr. LEE. Yes.

Mr. COURTNEY. It requires many years, or at least several years to train a draftsman in the course of his progress toward a scientific degree of this kind.

Mr. LEE. Yes.

Mr. COURTNEY. Now, if you would say that this man had that kind of talent, would you say there also would be an opening—I am taking a specific type of case to indicate how you reach these talents. Would you say that a person skilled in architecture would be useful for lesser categories than architecture, and how would you go about discerning those talents and using them?

Mr. LEE. In this particular example, the enlisted man—and in the case of an architect, since that is not in the scientific and professional personnel program which I described——

Mr. COURTNEY. No; I understand that. I am talking about your description of a program individually monitored by the Adjutant General to insure effective use of their skills.

Mr. LEE. Well, that is a special program set up where we have established a requirement. Now, architects don't happen to be in that group. I think it would be helpful to you if I described how this program works and then how the other works. Now, this program—for example——

Mr. COURTNEY. Well, let me ask you this much. You spoke of them having talent or a development in draftsmanship. As a matter of fact, the first 2 years of architecture are not greatly different from that of an engineering course; isn't that right?

Mr. LEE. That is generally correct.

Mr. COURTNEY. Let me ask you this simple question. Assuming a man of the character that I have described to you and knowing the

levies and needs of the United States Army, where would you expect him to wind up, after having been monitored by the Adjutant General?

Mr. HARDY. You don't have to ask him that. He would be a cook.

Mr. COURTNEY. No; he would be a truckdriver.

Mr. HARDY. Or a truckdriver.

Mr. LEE. In my opinion that would not be the case, for this reason, generally speaking.

Mr. COURTNEY. Let me just assure you, the unassailable and undiluted fact is that he was a truckdriver.

Mr. LEE. Well, in that case, there is a very bad classification and assignment.

Mr. COURTNEY. Well, as a matter of fact, Mr. Lee, isn't the fault of the whole system the fact that irresponsible and unqualified people are the people who are actually making up these assignment cards and the rest of it is entrusted to the IBM machine?

Mr. LEE. No, sir; I don't think that is the case. I think the problem area is, and the real basic difficulty is, that the requirements for skills that we have and the aptitudes, knowledge, and abilities of the people coming in never match at any one point in time. It would be ideal if they did. And the Army, in my opinion, has advanced systems of personnel management, and applies them by and large very well. Now, there are cases when there are instances where the same thing didn't seem to work correctly and there wasn't good administration. But I believe those are the exceptions and not the general rule.

I think the real difficulty is that the skills of the people coming in and the job requirements never match perfectly.

Mr. COURTNEY. Well, let me ask you this much. Now, isn't this a fact: that, after the draftee' first interview and the markings on the card, everything else with relation to his duties thereafter are handled by an IBM machine?

Mr. LEE. No, sir.

Mr. HARDY. If not by an IBM machine, it would be better if we had one, because my experience has been that this is one of the poorest jobs that I have encountered anywhere, this business of talking about determining what a man's skills are, and in fitting him into a job in the military where he can use those skills. And, if you don't get it done and he ever mentions it to his Congressman, the biggest disservice you could do would be to call it to the attention of the service, because then they will be sure to send him to Timbuktu, where you couldn't possibly use him.

Mr. LEE. I won't agree with that.

Mr. HARDY. Do you want me to give you some illustrations? Let me show you some illustrations. You have a nice deal here, and you haven't people that have sense enough to carry it out.

Mr. LEE. I think this is an area where it would never be perfect. You do get letters, and you do send them to us. But the reason why I say that the services are pretty good about correcting any cases that are called to their attention is because, for example, just this morning we got a letter back from the Army about reassigning a man to the Biological Warfare Laboratory at Fort Detrick, Md., who really had been incorrectly assigned in that he had been sent to an installa-

tion expecting some equipment to get there on which he could do certain work that he was qualified but, due to changes in plans, he was never really properly used. When that was called to their attention—and this was through one of the Congressmen—the Army reassigned him. We have numerous instances. This was an enlisted man.

Mr. HARDY. You mean you found some officer who was big enough to admit that there was a misassignment? Boy, you haven't a shirtail full of them in the whole Military Establishment. Once they have made an error, you can't make them correct it, because they lose face; that is, they lose stature.

Mr. COURTNEY. As a matter of fact, Mr. Lee, isn't this the weakest part of your wide program, in this respect?

Mr. LEE. It is my opinion that the services do a reasonably good job of classification and assignment, considering the size of the job they have to do. It is an area which can be improved, and we should always strive to improve.

Mr. COURTNEY. Well, isn't it the weakest part of your whole system, in acquiring and using skills and talents which are available to you?

Mr. HÉBERT. Is it, Mr. Lee?

Mr. LEE. I think it is one of the most——

Mr. HÉBERT. You have to have a weakest. If this is not the weakest, which is the weakest part of your system?

Mr. LEE. That is what I was trying to think about, and I think it is one of our most difficult areas, and I think that, no matter how good a job we do, it will never be perfect, and the Congress will get complaints.

Mr. HÉBERT. I understand you have quite an area of weaknesses, because you can't distinguish which is the weakest.

Mr. HARDY. Mr. Lee, you are not in the same fix as these boys that bear the stars, are you, because you have to stick up for your particular bailiwick, even if it is wrong?

Mr. LEE. No, sir. I am giving you what, in my opinion, is the correct judgment of the case.

Mr. HÉBERT. Well, which is the weakest? I will ask you again: Which is the weakest part of your program? They can't all be that weak.

Mr. LEE. I would say this is, perhaps, the area of greatest weakness; yes, sir.

Mr. HÉBERT. Mr. Lee, how large an operation do you have in the Defense Department, in this area; I mean in your position?

Mr. LEE. We have 12 people, sir, in the Office of Manpower Utilization; yes, sir.

Mr. HÉBERT. And what do those 12 skills consist of?

Mr. LEE. We have individuals with background in the personnel field, individuals who have worked in the services on organizational problems—for example, the design of tables of organization and tables of distribution where you specify your requirements for various jobs. Then we also have people who have statistical background, because much of this requires the analysis of figures.

Mr. HÉBERT. Well, in essence, this particular Office is an office of paperwork and statistics and theories—blueprinting?

Mr. LEE. They do the pick-and-shovel work for the Assistant Secretary of Defense, Manpower, Personnel, and Reserve, for whom we work, on any policies in this area.

Mr. HÉBERT. What is your background in this field?

Mr. LEE. I am a graduate of the University of Texas Law School, with a master's degree from the University of Texas in the field of personnel administration. I have had 20 years of experience now in personnel and manpower work in Government and industry, the last 10 years of which have been in the Office of the Secretary of Defense, because I went to work when Mr. Forrestal was sworn in.

I formerly was Director of the Organization and Method Division of the Office of the Secretary of Defense. At that time, I worked for Gen. Joe McNarney, who was detailed to the Office of the Secretary of Defense. And for the last 7 years I have worked in the manpower and personnel field for Mrs. Rosenberg, and then, later, Dr. Hannah and Mr. Carter Burgess.

Mr. HÉBERT. In reality, it is an office, as I suggested, of blueprinting of the desirable objective; isn't that it?

Mr. LEE. Yes; that is part of the work.

Part of it is the desirable objective. Another thing that we do a great deal of, Mr. Hébert, we actually go out in the field to the bases and the headquarters and conduct field studies and spot checks of how the services are utilizing these people. Because utilization does take place right there on the job in the grassroots, we get firsthand observation of what they are doing.

Mr. HÉBERT. Now, do you give any direction to the various services?

Mr. LEE. Policy direction; yes, sir.

Mr. HÉBERT. Just merely policy direction, because your paper, for the most part, is a recital of what has been told us here on that program. I was just wondering what check you had on them and which direction you gave it.

Mr. LEE. Through field surveys. They themselves have classification and assignment teams. Occasionaly, we will make a spot check with one of these teams to see how they are doing and, occasionally, we will go out on our own. For example, we have now, for most of the functions we have—be it the hospitals, installations, or training centers or whatnot—we have staffing patterns in which are generally prescribed by the services the skills that are needed for this job. Now, that whole program was, 5 years ago, developed by my office in cooperation with the services. Here, just 5 years later, we are getting the payoff on this thing. So, we do what you might call systems-planning work, too.

But the actual day-to-day administration has to be done by the services, because you know that at this level we are too far removed from actual operations to do it.

Mr. HÉBERT. You are merely a policy outfit.

Mr. LEE. And we review and audit what they are doing.

Mr. WILSON. Mr. Lee, do you keep any statistics or do the individual departments keep the bulk of statistics on—for instance, does the Department of the Army know how many bachelors of science in engineering they have in their enlisted ranks and in their officer ranks?

Mr. LEE. Yes, sir.

Mr. WILSON. Could you tell us for the record how many?

Mr. LEE. I have with me the figures on officers. I do not have the enlisted figures with me. But on officers in the Army we have doctor's degrees in the physical sciences, 54, master's 369, bachelor's 8,487.

In engineering in the Army: doctor's degrees 19, master's 1,559, bachelor's 5,335.

In the Navy, physical science: doctor's 28, and master's 324. And we do not have a breakout by physical science by the Navy in this figure nor by engineering.

But there, the total of all bachelor's was 32,000.

In the Air Force, we have doctor's in physical science, 74, master's 600, and bachelor's 5,596.

In engineering, doctor's 32, master's 1,000, and bachelor's 12,009.

Mr. WILSON. Now, you say you don't have with you the enlisted figure.

Mr. LEE. No, sir.

Mr. WILSON. But can you get those for us?

Mr. LEE. We would be glad to get them for you.

(The information is as follows:)

DEPARTMENT OF DEFENSE—INFORMATION REQUESTED BY SPECIAL INVESTIGATING SUBCOMMITTEE, HOUSE ARMED SERVICES COMMITTEE, MARCH 31, 1958, HEARING

1. Estimated number of enlisted personnel by academic degree and major field

Service	Degree	Total	Physical science	Engineering	Law	Other
Army [1]	Bachelor	30,634	2,080	2,933	1,420	24,201
	Master	2,357	133	58	22	2,144
	Doctor	785	7	1	4	773
	Total	33,776	2,220	2,992	1,446	27,118
Navy [2]	Bachelor	1,273	106	322	23	822
	Master	57	8	12	6	31
	Doctor	7	1	0	1	5
	Total	1,337	115	334	30	858
Air Force [3]	Bachelor	4,251	----------	----------	(358)	----------
	Master	918	----------	----------	----------	----------
	Doctor	201	----------	----------	----------	----------
	Total	5,370	----------	----------	----------	----------

[1] Data partially estimated.
[2] Navy figures represent personnel on active duty Dec. 31, 1957, excluding the few remaining selective service inductees.
[3] Data partially estimated; breakdown by major field not available.

2. Actions taken to minimize the number of administrative reports required of professional personnel in the scientific and engineering fields

Army

Under a "Men Friday" program inaugurated at Fort Belvoir, young college graduates, as assistants to technical personnel, provide administrative support at the working level, enabling the engineering staff to spend more time on primary duties.

At the Diamond Ordnance Fuze Laboratory, representatives of the staff offices have been assigned to each major research organization and are physically located at the worksites. They handle the following staff and service functions and reports for the technical staffs: personnel management, contract negotiations, procurement, property control, budget preparation, et al.

The Engineer Research and Development Laboratory, in a study of professional positions associated with their standardization and item simplification project, found that the professional staff which determines the level of production of the entire operation, was dividing its time among professional level tasks, subprofessional technical tasks, and clerical and administrative tasks. By assigning the clerical and administrative tasks to clerks and assistants, the specialists were able to devote the time formerly spent on administrative detail to their professional work.

Related to the foregoing programs, is a skills utilization index, which was developed and field tested as a device for determining the extent to which professional skills are actually used on-the-job. Under this system, salary and wage analysts, as part of their regular positions audits, determine the percentage of time spent by engineering or scientific employees on professional work. This is esentially a flagging system to indicate the needs and possibilities for job reengineering, to make better use of scarce skills.

An armywide directive has urged the establishment of scientific and engineering skill utilization committees at all installations employing professional personnel in these fields to analyze, review, and coordinate job engineering studies and management surveys in the reengineering and maximum utilization of professional skill.

Navy

In the past year 2,078 reports involving 115,000 man-days have been eliminated within the Navy as a whole.

Wherever practicable, the Navy is assigning administrative personnel to relieve scientists and engineers from administrative duties. An on-site survey team is visiting activities to determine, among other considerations, what further measures can be taken along these lines.

Air Force

Administrative personnel have been assigned, as necessary, to research and development work to handle administrative reports. Virtually the only reports required of Air Force scientists and engineers are technical reports dealing with the results of their work or evaluating technical achievements within their field of interest.

In connection with Air Force contracts with civilian scientists and engineers, action has been taken to simplify the reporting procedures under Air Force research and development contracts.

A large number of research contracts are now being written to require only letter progress reports or bimonthly reports instead of the formal monthly progress reports.

Mr. WILSON. Can you tell us what percentage of those, who have those degrees, are employed in skills within the services alined with their training?

Mr. LEE. My estimate would be that approximately 50 percent are employed in jobs which directly apply their college educational background. And nearly half of them, to the extent that we have proper classification and assignment, would be employed in related jobs. By related job, for example, I mean the kind of an example Mr. Courtney cited, where an architect was used as a draftsman.

We would not consider that really first rate utilization, in that the draftsman's skill is at a lower level of skill from the architect.

Now, as we have gone out in the field with the services, we do find at any one time—it used to be a little higher, but this last year on our spot checks we found about 5 percent of the jobs we spot checked represent what we consider to be out-and-out misassignments. And of course—some of them are the source of the letters you get and I suppose you would judge, by the number of letters, that you must be getting all of the 5 percent.

But I do believe that the services do a reasonably good job in this area.

Now, we have—I do think that the fundamental problem is in the Army particularly, that our requirements and skills of the people coming in do not match. We have in the Army on all enlisted jobs—we have 20 percent of all enlisted jobs in the category which we call ground combat, which consists of the artillery, infantry, and all the ground combat units.

Now we have no direct counterpart in civilian life for those jobs. Now, some of those positions are leadership positions and pretty important positions.

And we will occasionally get someone with a college degree in the ground combat arms. Now, the thing that is not defensible is when one of them turns out as a truckdriver. We do not try to defend it, and neither does the Army, and they will change it, or have, in all cases.

Mr. COURTNEY. Except to send them overseas in the same category. I just stated that as an instance.

Mr. HESS. I would like to follow up there just a moment, Mr. Lee. Do you happen to have any figures there with reference to the bachelor or doctor's of law degrees?

Mr. LEE. No, sir, because I have them broken out by physical science, engineering, language and others. I don't have—did you mean lawyers?

Mr. HESS. That is right.

Mr. LEE. I don't have the lawyers, but we could get these figures for the committee, if you wish.

Mr. HESS. Could you get them? I would like to have them.

And I would like to find out also approximately what percentage of the lawyers, for instance, either have doctor's or bachelor's degrees or who are in the Judge Advocate General's department.

Mr. LEE. All right, sir.

Mr. HÉBERT. You will supply that for the record.

Mr. LEE. Yes, sir.

(The information referred to is as follows:)

Military personnel possessing law degrees[1] and number assigned to JAG activities

Service	Bachelor's degree	Master's degree	Doctor's degree	Total	Number assigned JAG activities
Army:					
Officers	1,818	81	16	[2] 1,915	996
Enlisted	1,358	70	18	1,446	386
Total	3,176	151	34	3,361	1,382
Navy:					
Officers	868	17	1	886	427
Enlisted	23	5	0	28	0
Total	891	22	1	914	427
Air Force:					
Officers	1,504	94	40	1,638	1,059
Enlisted	45	13	11	69	20
Total	1,549	107	51	1,707	1,079

[1] Military personnel with law degrees are assigned to JAG activities, to general counsel offices, and to positions in the technical and administrative services, bureaus and commands which require the performance of legal duties.

[2] Includes 22 warrant officers.

NOTE.—The above figures for enlisted personnel supersede comparable figures shown in the DOD Report to the House Special Investigating Subcommittee of Apr. 11, 1958. As noted in the original report, the data was partially estimated; the above figures are based on statistical reports.

Mr. HESS. There have been some bills introduced to pay them incentive pay and that is the reason I would like to have that information.

Mr. LEE. Yes, sir.

We will get that information.

Mr. HARDY. I would like to pursue this just a little further. Of course, unless you do a satisfactory job right in the beginning of draftees, your whole process that you have outlined on this page 8, breaks down. And even if you do a satisfactory job there, unless the job is done at the end of his basic training toward getting him in the right spot, why still the whole thing breaks down. And if, during his basic training there has developed somebody's notion to make a truckdriver out of him, it doesn't make a doggone if he has a doctor's degree, does it?

Mr. LEE. Yes, I think the only way he could become a truckdriver is by misadministration of the program.

Now, the most recent figures I have are from last November. At that time, enlisted personnel, which is what we are talking about: we had 5,555 enlisted personnel in the Army with a scientific, engineering, or business management degree. Now, at that check, we had 3,800 of them in a job which directly utilized their college education and training and the balance of them in one of these related jobs in which we feel that the utilization is less desirable.

Now what the Army does with those kids: they have MOS's, military MOS's, in civilian engineering assistant, mechanical engineering assistant, mathematics statistics assistant, chemical engineering assistant, electrical-electronic engineering assistant, physical sciences assistant, physiological sciences assistant, social sciences assistant, and business administration assistant.

Now, these jobs are at laboratories or test centers, like Edgewood Arsenal or Aberdeen or Redstone. And these youngsters are identified as they come in on the basis of a personal interview and their personnel records; and sent by the Adjutant General to one of these places.

Now, when we have more of them—as you can see from the numbers here, we have on the order of 1,000 more at the time this report was taken than we had scientific and engineering jobs—we, as a matter of policy, use the extra thousand in related jobs. For example, one might do computer work in a guided-missiles unit, which really is related to this college training, but wasn't exactly the type of thing he planned to do with it, whereas these assistant type jobs, except for the fact that they are in the military and he planned to have his career in RCA or somewhere, are the type of thing he would be doing, by and large, if he had gone from school into industry.

So we have to use some of them in related jobs, and occasionally we have some defects in administration of the program, and some of them slip through and aren't identified. But by and large, in my opinion, the services do a reasonably good job of handling large numbers—the Army does, because they are the only ones that are using the inductee—of using a large number. And they have this special system for doing it.

But I did testify a minute ago that this was perhaps one of the weakest areas, or the weakest area, because it is difficult.

Mr. HARDY. We are having a hard time. I wish I could share your enthusiasm and optimism over the results that are being achieved in this program. From what little I have seen of it, the picture of what you are planning to do from a theoretical point of view may be fine, but I am not at all sure that you can get objective statistics that will

support your picture of satisfaction with what is actually resulting from it.

Now, on page 8 you spoke of these qualified people being identified as they enter military service, and then being assigned to these designated positions, and then you follow up by saying:

> Their utilization in these positions is monitored individually by the Adjutant General.

Now, just what do you mean by that? How does the Adjutant General monitor the utilization of these people?

Mr. LEE. They have survey teams that go out in the field, and look at what these men are doing and look at their background and make a judgment whether or not they are properly assigned and classified. Now, these people also have a separate grievance procedure, as it were, over and above that procedure available to all soldiers. Because any soldier can ask the Inspector General to look at anything the Army does.

Mr. HARDY. You don't want this committee to believe that every single individual job is scrutinized by the Adjutant General and found to be properly or improperly assigned and utilized?

Mr. LEE. I should have conveyed, Mr. Chairman, that this individual monitoring refers specifically to these 5,000 jobs in the scientific and professional program.

Now, the Adjutant General gets to each base twice a year. In other words, they do go out in the field. We have gone with them. I, myself, have been to most of these installations and talked to the men and seen the kind of work they are doing. It is very similar to what our civilian scientists are doing in the same laboratory.

Now, the difficulty is that they are soldiers.

Mr. HARDY. Yes, but you didn't mean that every individual who was assigned to one of these jobs was checked up by the Adjutant General?

Mr. LEE. In each case, each individual assigned to this job: his records have been reviewed by the Adjutant General and his job duties have been reviewed by the Adjutant General. I don't mean each one has been personally interviewed, because that is not the case.

Mr. HARDY. I wasn't thinking about that. But you said a moment ago that an Adjutant General's team got around to a base about once every 2 years.

(Mr. Lee nods.)

Mr. COURTNEY. The draftee would be out by that time.

Mr. HARDY. Yes, he is gone. Still, you got the word "individually" here, and I don't believe it. I don't mean for us to believe that every one of these individual boys, when assigned to these jobs, is followed up by the Adjutant General to see that he is properly placed.

Mr. COURTNEY. You have described your function in your office as a policymaking function?

Mr. LEE. With a review.

Mr. COURTNEY. With review. You have described the trips, the proper trips to inspect and ascertain the implementation of the policy which you have described. Now, assuming that you find cases—and I assume you must have found cases—where the philosophy that you have expressed here is not being carried out; what can you do about it, what can your office do about it, and what do you do about it?

Mr. LEE. We ask the Army to correct them. We have not found a great deal of resentment or resistance against correcting an assignment. I think I tabulated the number a while back for some congressional inquiry. I don't trust my memory on the number now, but the Army has been very good about correcting them.

Now, there are some times that they don't agree with us, and if they don't, they can state their case, and it ultimately could be referred on up to the Secretary of Defense, conceivably. But in general, the Army has been anxious to do, in my opinion, a good job in this area.

I keep talking about the Army because they are the service that has draftees. In the Navy and the Air Force, usually in enlisted personnel we don't find many of these college graduates in the sciences and engineering, at the enlisted level, as you know.

Mr. COURTNEY. What are you doing about the matter of training these scientific personnel in languages, other than the English language, so that they may avail themselves of scientific data?

Mr. LEE. With respect to service programs, as I have indicated, the requirement of scientists and engineers is largely a civilian requirement, in that we do not have military officers at the workbench or at the project bench, except for these draftees that I mentioned. They are actually working on research and development projects.

So we do not have a language requirement for military for training scientists and engineers in language. We have a large language-training program, but that is largely for people assigned to attaché, MAAG, mission, and duties like that, rather than scientists and engineers.

Mr. COURTNEY. Let me ask you this, then: On this ROTC program—and you spoke principally and properly, as the inquiry was directed to you, on the scientists and engineers being enrolled and trained under that program.

Do you prescribe the curriculums or do you have minimum curriculums which would be required in order to conform to this program?

Mr. LEE. For the ROTC?

Mr. COURTNEY. Yes.

Mr. LEE. The services set up standards for the curriculums.

Mr. COURTNEY. That does not come through your office, then?

Mr. LEE. No, sir. No, the ROTC curriculums do not. Not the curriculums.

Mr. HÉBERT. I notice in your statement, Mr. Lee, you said that in the ROTC you would defer the student if he wanted to obtain a master's degree?

Mr. LEE. Yes, sir. He won't be ordered to active duty. He would be postponed from active duty, in order to get his master's degree.

Mr. HÉBERT. Is that in any particular area for that master's?

Mr. LEE. In science and engineering.

Mr. HÉBERT. I wanted to be clear on that.

Mr. LEE. There may be some others. I think the policy is worded in terms of critical occupations, but it is largely science and engineering.

Mr. HARDY. Now, would that include such things—I am getting a little beyond the master's. But I had a veterinarian the other day in here that was in trouble on that score.

Mr. LEE. Their ordering to active duty is postponed while they get their veterinarian degree, unless they want to voluntarily come in.

Mr. HARDY. They wouldn't defer this boy to let him finish his degree, and he only lacked half a year. He only lacked half a year from completing his PMD, and he was ordered inducted. We got it changed, but I had an awful lot of doing to get it done.

Mr. LEE. I don't know the particular circumstances in that, but to my certain knowledge——

Mr. HARDY. This wasn't ROTC.

Mr. LEE. The boys in the veterinary schools are allowed to complete their training. Of course, this man was not in the ROTC program?

Mr. HARDY. This was draft.

Mr. LEE. This policy I spoke of refers to enrollment in ROTC.

Mr. HÉBERT. That was set up last year, I think, wasn't it?

Mr. LEE. Yes, sir.

Mr. HÉBERT. Through Mr. Milton's office?

Mr. LEE. Well, it is a defense policy. So it is in the Army, which is his office, as well as the Navy and Air. They all agreed to it.

Mr. HÉBERT. I know it was an overall program.

Mr. LEE. Yes, sir.

Mr. HÉBERT. I was very much interested in that program.

Mr. LEE. Very constructive, I think.

Mr. COURTNEY. Do you have any plans in the Department of Defense to do something about the curriculums of these students who are in the ROTC program, particularly in the scientific and engineering fields, to insure a balanced program or a program which is reasonably uniform or which will adapt itself to your requirements? You say you have none now. I ask you if you do have any plans.

Mr. LEE. We do not have a standard curriculum in the sense that it is standard for all services.

Mr. COURTNEY. I say, do you have any plans for the future?

Mr. LEE. And in all probability the requirement is such that you would not want to standardize it. We do not have plans for that.

Mr. HARDY. I have 1 or 2 more questions, Mr. Chairman.

Mr. HÉBERT. Sure.

Mr. HARDY. On the last page of your statement, Mr. Lee, you refer to an administrative job and the assignment of assistants to relieve these scientific people of their administrative work. How is that working out?

Mr. LEE. This program was experimented with by the Army at Fort Belvoir and is a very interesting one, and has since been extended. What they do is they get a college kid who has been trained in business administration and they have him do the budget work and the paperwork for several research teams. So he might be doing all the paperwork, or a large part of it, for 50 or 60 scientists and engineers, and they like it, because——

Mr. HARDY. How far have you gotten with that?

Mr. LEE. It has been in operation in the Army for well over a year—you mean do we have that at every laboratory??

Mr. HARDY. Well, it isn't very widespread, I take it, because that has been one of the major criticisms I have heard coming from these scientific people.

Mr. LEE. That is one of the major criticisms, but it is mixed in the sense that a great many of them would like to be relieved of administrative duties. On the other hand, they recognize that if you go on up the ladder and run a laboratory, you are going to have a certain amount of managerial or administrative duties and paperwork.

So you find them divided, almost half and half—about half of them wanting to be relieved and the rest of them thinking that they would like to do their own work in that area.

Mr. HARDY. Well, I think you run into a little bit more of a complication than that. It is a question as to the extent to which that administrative work can be assigned to somebody else who didn't actually do it?

Mr. LEE. Yes.

Mr. HARDY. Didn't actually perform the functions himself. Then you have a problem of relaying to another individual information that you could put down yourself to start with.

Mr. LEE. That is correct, sir; it is a difficult thing.

Mr. HARDY. Then the complaint was the reports that were required and the detailed redtape that the Army imposed on these people. I wonder if there has been any steps taken to try to reduce that requirement, rather than to try to substitute somebody else to perform the work?

Mr. LEE. Yes; we do have reviews of reports to see if they are absolutely needed periodically. We don't seem ever to be able to get away from it, and from the number of reports as much as we could, and this plan has had some appeal from the standpoint of the scientists and engineers.

Mr. HARDY. I am more interested at your working at this business of trying to cut down on the redtape that is involved.

Mr. LEE. Yes, sir.

Mr. HARDY. I think it would be helpful if we could have some evidence of progress in that direction, and maybe you could relieve the requirement for some of these administrative assistants.

Mr. LEE. That would be the best way to do it, if we can possibly minimize the number of reports.

Mr. HARDY. Mr. Chairman, I have just one other point here that I wanted to make one brief inquiry about.

On page 3 of your statement you spoke of permitting qualified scientists and engineers working in research or defense industry to discharge their military obligation by volunteering for 3 months of active-duty training. How extensively is that being done?

Mr. LEE. There is a cumulative figure of 3,400 scientists and engineers in this particular program since its initiation in 1956. We are presently engaged in a little study to see why more of them haven't come into that. We don't know whether it is the lack of widespread knowledge of it or, of course, that particular route has a longer Reserve obligation, as you probably know. In other words, the active duty and the Reserve have to total 8 years if they entered after 1955.

Mr. HARDY. Now, with your experience in that, have you made any evaluation of what these people really get out of that 3 months' active duty?

Mr. LEE. That would be a matter of opinion. My own opinion would be that a man gets very little over and beyond what you get in basic training, which is a knowledge of what is expected of you as a soldier, and whatever little jump that gives you if, in the event of mobilization, you were ever called back in with respect to these people.

Mr. HARDY. Well, my whole question was centered around the question, in my own mind, as to whether we are or are not wasting

the entire cost of that 3 months' proposition. If that is the case, then the sooner we stop that and put that money back in the kitty, the better off we are going to be. Because how in the world can you take a fellow that is a scientist working in defense industry and put him on active duty and get him into basic training for a period of 90 days?

(Mr. Lee nods.)

Mr. HARDY. And then expect him—all in the world he has done is interrupted his occupation.

(Mr. Lee nods.)

Mr. HARDY. It sounds awful silly to me.

Mr. WILSON. Mr. Lee, I understand when the Cordiner Committee was first set up, one of its missions was to look into the problem of proper utilization of manpower in the civilian field in the military and scientific and technical areas. What happened to the recommendations from the Cordiner Committee, as far as civilians is concerned?

Mr. LEE. My recollection of their recommendations is that they were concerned with this problem of relieving the scientists and engineers of administrative duties, in which we have installed these "Man Friday" plans at our various laboratories. It is a step in that direction.

Another recommendation that they made was to liberalize the attendance of these scientists and engineers at professional meetings, so that they could interchange their information about their research projects more. And the Secretary of Defense did ask the services to change their relatively strict criteria for attendance at these meetings.

We, in my office, did complete a review of that particular area in the year since the Cordiner report. And my recollection is that it has increased about 20 percent in the last year, in terms of attendance at such professional meetings. The rest of their recommendations pertained to developing a civilian career ladder, or better, civilian career ladder for civilian scientists. It was to be developed by the Civil Service Commission. Their main one, of course, their major one, was on salaries, on which, as you know, there is legislation now pending.

Mr. WILSON. Is there legislation that deals with scientific personnel as a direct result of Cordiner's hearings on that problem?

Mr. LEE. I would not be the expert as to whether it was a direct result, because this is an administration bill that was discussed in previous sessions before there was a Cordiner report.

Mr. WILSON. Do you think pay—that is, the fact that scientists in the civilian side of the military are relatively low paid, is one of the reasons they have such a problem of retaining such scientists?

Mr. LEE. On the civilian scientists, our attitude surveys show that the great majority of them, or perhaps two-thirds of them, or two-thirds to three-fourths who leave us, do so because of pay. That is, civilian scientists.

Mr. WILSON. That is all, Mr. Chairman.

Mr. COURTNEY. Mr. Chairman, that concludes the departmental presentation on this phase of the subject.

I think that is all, Mr. Lee. You were to be the only one?

Mr. LEE. Yes.

Mr. COURTNEY. Thank you very much.

Mr. LEE. Thank you very much.

Mr. HÉBERT. The committee will stand in recess.

(Whereupon, the committee recessed.)

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